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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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The Chemistry of Oils and Fats

IT has been said—and few will disagree with the contention—that the first decade of a revolutionary chemical process is usually a period during which a relatively large bulk of often conflicting data becomes reduced, by a process of elimination and simplification, to certain more or less generally accepted rules, while at the same time the plant employed passes through a similar process of elimination and selection, thus approaching what we call "standardisation." The developments which have occurred in the oils and fats industry within recent years may without fear of contradiction be characterised as revolutionary; but there are a number of indications that the technique associated with the use and working up of these materials is approaching a position of greater stability. This does not mean that finality has in any way been approached; but—to quote a recent opinion of one of the leading authorities—the very large tonnage of oils now hardened annually, combined with the very small number of fresh patent specifications which have lately been issued (in contrast with the large number taken out during the initial development of the industry) is symptomatic of the process of elimination and of a healthy growth along those lines which have been found in practice to give the best results. Thus radical deviation from present methods is not likely.

As our knowledge of the application of science progresses it is found that materials which were at one time regarded as waste or of almost nominal value spring into prominence as the staple raw products of some comparatively valuable finished substance. This is a consideration which may operate advantageously and disadvantageously at the same time. For instance those who control the supplies of the formerly low-priced material will derive benefit from the demand which arises for it; on the other hand, its appreciation in value may be so continuous and substantial that it may eventually act to the detriment of the new process which has occasioned the demand for it. The oils and fats industry—particularly so far as those oils which are suitable for hardening are concerned—supplies a notable instance of continued appreciation in value of the raw material—appreciation the magnitude of which is beginning to deter those who might otherwise be in a position to extend considerably the use of the process. During the early development of oil-hardening the applications mainly contemplated were for the manufacture of soap and candles; but now it is found that modern developments in the employment of these oils in the edible fat industry are of the highest importance. Many of the earlier drawbacks have been surmounted, such, for instance, as the elimination of the characteristic taste. Moreover, the complete removal of the catalyst now presents little difficulty, while care in the treatment of oils in the earlier stages of manufacture has more or less disposed of the problem of rancidity.

One of the newer branches of the subject which presents illimitable possibilities is the synthetic preparation of fatty acids by the oxidation of petroleum and similar hydrocarbons. Originally the study of such processes undoubtedly arose from necessity and urgent need in Germany, but it would seem that no great progress is being made with what is unquestionably a difficult though fascinating problem. Oils of the kind are highly complicated mixtures; and, as the German workers themselves admit, a solution is likely to be found by accident just as much as by definite research.

The Food Value of Synthetic Fats

FOLLOWING up our practice of devoting one issue of THE CHEMICAL AGE each month to some particular phase of industrial or commercial chemistry—a custom which, judging from opinions frequently expressed by our readers, is widely appreciated—we are allotting a large part of this week's issue to the study of the oils and fats industry. In publishing special numbers we do not set out with the intention of catering for the experts in the particular branch of chemistry selected; rather the aim is to enlist the services of these experts as contributors so that our pages may be regarded as a reliable reference for those readers who may at the present or at some future date be seeking up-to-date information. On this occasion articles are published from two authorities who as contributors are new to THE CHEMICAL AGE, but whose names are well known, respectively, in the academic and industrial chemical worlds. Dr. Myddleton treats generally of the industrial uses of hydrogenated oils, and he brings out some interesting facts in connection with that vexed question relating to the food value of synthetic fats and their ability to replace solid fats. In these columns frequent reference has been made to the important *rôle* of vitamins, the presence of which would seem to be essential if the body is to utilise efficiently the food supplied. As is well known, vitamins exist in animal oils and fats, but they are apparently destroyed during hydrogenation. In the present state of our knowledge it is not, perhaps, possible to determine the minimum vitamin content of a synthetic fat which could be regarded as a complete substitute for animal fat, but Dr. Myddleton comes forward with the suggestion that the incorporation of small amounts of some such substance as cod liver oil would remove the last reproach from the synthetic fat as a staple food. In other directions there is now practically no need for alarm so far as any deleterious effects of these modern food substitutes are concerned. As mentioned above, removal of the catalyst now presents little difficulty, and it has been shown that nickel, even if it is taken in small quantities, is almost completely passed out from the system. The majority of modern products, however, contain no detectable amount of the catalyst.

Mr. G. D. Elsdon, who contributes an article on "The Analysis of Margarine," follows up this question of catalyst removal, and emphasises an important point which might easily be lost sight of. Although there are many hardened oils on the market which do not give any reaction for nickel, this is no guarantee that the catalyst has been eliminated, for the reason that some other catalyst may have been used. Accordingly, a negative result for the presence of nickel must not be considered conclusive. So far as food value is concerned, Mr. Elsdon's opinions are in agreement with those of Dr. Myddleton, and he contends that, as vitamin fat-soluble A is entirely absent from lard, vegetable oils, and hydrogenated oils, no staple food such as margarine can be considered satisfactory from the nutritional standpoint unless it contains a reasonable proportion of beef fat or butter. The two other special articles which are included in this issue deal with somewhat different phases of the industry. Mr. Hedley Barry writes on the subject of soaps and modern detergent theories, while a well-known industrial chemist deals with the cultivation of the olive and the production from it of the well-known vegetable oil.

Some Centenary Lessons

As anticipated in our previous issue, the centenary celebrations of the British alkali industry last week were a complete success, and of quite unusual interest from every point of view. The great assembly which met at the Adelphi Hotel, Liverpool, was one of the most representative in the history of British chemical industry. Practically every aspect of industrial chemistry in the country was represented, and few who were privileged to be present would willingly have missed so notable an occasion. The United Alkali Co. may look back on last week's events with real satisfaction. The speeches at the dinner, as predicted, were very well worth hearing. Among them may be singled out General Thuillier's survey of the country's debt to chemistry during the war, Mr. R. G. Perry's speech in proposing the toast of the evening—admirable in its phrasing, in its perspective, and in its light but clear delineation of the milestones in a century's progress—and Sir Max Muspratt's happy and informing exposition of the company's policy and achievements.

From a great mass of detail several points of importance to chemical industry in general emerge. Speaker after speaker emphasised the fundamental importance of sound science and sound technology. The success, too, with which the company has adapted itself to changing conditions demonstrates anew that in industry, as in biology, the organisms capable of rapid correspondence to environment are the only types that survive. Another feature properly emphasised was the steady growth of co-operation, not only between the Le Blanc group of companies, but between chemical manufacturers as a whole, and between them, again, and Government departments and officials. Nothing could have illustrated the underlying unity more happily than the presence and speech of Mr. Roscoe Brunner, expressing the cordial friendship and goodwill of two great concerns whose competitive contact at points has only served to promote the common progress of British industry. The causes behind these fine results were summarised as scientific and commercial efficiency, the proper utilisation of raw materials, and freedom from labour troubles. The last advantage, as Mr. Perry said, may be largely due to the fact that the employees of our great chemical companies are drawn so largely from the educated classes, and the moral drawn from it that industry can only gain from their employment in ever-increasing numbers will well bear repetition. But another factor, as Sir Max Muspratt pointed out, has also played a great part. Vast as the alkali organisation has become, the personal links between its controllers and its staff have never been lost. The traditions and the qualities of the founders survive to-day in their children and grandchildren, and the evening could not have ended on a higher note than Sir Max's warm appeal

that idealism, and even something of mysticism, should be retained as a leavening and humanising influence in all material progress. A record of the kind which last week's celebrations supplied is good for everybody. It inspires confidence and co-operation among British chemical manufacturers themselves, and it benefits British industry as a whole by enhancing the reputation of British products throughout the world.

German Potash and Nitrogen

ACCORDING to the *Deutsche Bergwerks Zeitung* of April 8, the policy of making a price reduction for German potash dependent on reductions in coal prices and the coal tax has latterly been much discussed. The Potash Syndicate has introduced a small price reduction as from April 6, which, however, is regarded as of little consequence from the point of view of increasing sales, as the agricultural industry, in expectation of further price declines, is holding back its orders. In the meantime the position of the German potash works will necessitate short time working in the near future. Many are already on short time, and probably during the next few months will have to work on stock to an increased extent. The accumulation of stock entails heavy expenditure, and the potash works are complaining more and more of a shortage of working capital. The extra proceeds derived from export business are, owing to the depreciation of the mark, no longer so great as formerly. The position is intensified by the fact that the rock salt business, which used to bring in considerable sums, is at a complete standstill. The complete closing down of works, according to the journal referred to, can only be avoided if the necessary working capital is obtained, and nothing remains, therefore, but to have recourse to the open market.

With regard to the nitrogen position, the *Kolnische Zeitung* of April 9, states that since 1913 the consumption of nitrogen in Germany has more than doubled. From 6 kilos per 2·47 acres of land under cultivation before the war it had advanced in 1922-23 to 12·2 kilos per 2·47 acres. This has only become possible by making German nitrogen requirements more and more independent of foreign sources. The Haber-Bosch process put an end to the former monopoly of saltpetre. In the middle of the late war large works sprang up in the neighbourhood of Merseberg, called Leunawerk, after the name of a neighbouring village, which, together with Oppau, now cover the greater part of the nitrogen requirements of the German agricultural industry. The Leunawerk employs some 15,000 workers. At present the works are still fully employed, but the nitrogen industry makes no secret of the fact that some anxiety is felt for the future. Statements to the effect that the demand or sulphate of ammonia has greatly diminished and has even come almost to a standstill have been confirmed. The prices for cereals have declined, whereas the nitrogen industry, in view of production costs, coal prices, and wages, has not been able to make a reduction. In the event of the home demand failing to absorb supplies, it is suggested that the nitrogen industry might be given greater freedom in the utilisation of its products, and the question has been raised whether the export prohibitions should remain in force.

Caution to Inventors

WE are asked to draw the attention of inventors to a notice headed "Caution to Inventors," which has been inserted by the Comptroller-General of Patents in the *Illustrated Official Journal* at the request of the Chartered Institute of Patent Agents. The notice reads :—"Inventors are advised to beware of suggestions such as are now being issued from a German source to the effect that, for reasons obscurely stated by the German writer, the British inventor should co-operate with him and in particular should send him by registered letter a sum of money. On no account," the notice adds, "should money be sent."

Points from Our News Pages

Special articles appear on "Modern Theories of Detergent Action, by T. Hedley Barry; "Industrial Uses of Hydrogenated Oils," by W. W. Myddleton; "The Analysis of Margarine," by G. E. Elsdon, and on the Manufacture of Olive Oil (p. 446).

Reports are published of the celebrations in connection with the Centenary of the Alkali Industry (p. 454).

Letters are published from Mr. H. Doop Richmond on the title "Chemist" and from Mr. R. G. Johnston on Laboratory Porcelain Crucibles (p. 459).

Mr. E. Kilburn Scott completed on Monday the course of lectures on Nitrates from the Air (p. 459).

The importance of joint action and the value of chemical clubs to the industry was emphasised at a Joint Dinner at Newcastle (p. 461).

Our London Market Report states that there has been a steady turnover, though business has not been good (p. 467).

Business remains quiet, with little change, according to our Scottish Market Report this week (p. 470).

The Calendar

May 1	Northern Polytechnic Institute Chemical Association: "Coal Washing." T. J. Drakeley. 8 p.m.	Holloway, London.
2	The Institute of Metals: Annual May Lecture: "The Inner Structure of Alloys," by Dr. W. Rosenhain. 8 p.m.	The Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.
2	Society of Public Analysts: Ordinary meeting. 8 p.m.	Burlington House, Piccadilly, W.1.
3	Chemical Society: Ordinary Scientific Meeting. 8 p.m.	Burlington House, Piccadilly, W.1.
4	Society of Chemical Industry (Manchester Section): "Reflections on Patents." Howard Cheetham. 7 p.m.	16, St. Mary's Parsonage, Manchester.
4	Chemical Engineering Group: Annual General Meeting. 6.30 p.m.	Engineers' Club, Coventry St., W.1.
4	Royal Institution of Great Britain: "The Origins of the Conception of Isotopes." Professor F. Soddy. 9 p.m.	21, Albemarle St., Piccadilly, W.1.
4	Manchester Literary and Philosophical Society (Chemical Section): Annual Meeting. 7 p.m.	36, George St., Manchester.
7	The Institution of Rubber Industry: "The Use of Rubber Products as Dielectrics."	London.
7	Society of Chemical Industry (London Section): Annual Meeting.	Engineers' Club, Coventry St., W.1.
8	University of London: "The Electric Charge of Colloids." Dr. B. R. Kruyt. 8 p.m.	Dept. of Chemistry, University College, Gower St., W.C.

Modern Theories of Detergent Action

By T. Hedley Barry, F.C.S.

The author gives an outline of the principal researches on which modern theories of detergent action are based. The relative importance of individual properties, such as hydrolysis and surface tension, is discussed with special reference to industrial problems.

(*For references in text see page* 448)

THE fact that caustic alkalies combine with fats and oils to form a water soluble substance possessing valuable detergent properties has been known for many centuries. According to Pliny the Gauls invented the process of boiling plant ashes with fats, and the same writer also mentions soaps of lime and of lead. Remains of a soap factory have been found in Pompeii. Although there are various references to soap prior to Pliny's time, the nature of the substance referred to is not known with certainty. The Hebrew word "neter," which is translated soap in the Old Testament, probably applied to a product better described as soda. In Europe the Italians and Spaniards were the earliest soap makers, but in the fourteenth century Marseilles became prominent and has retained its position ever since. The first patent in England was granted in 1622.

The introduction of the Leblanc process in 1791 gave the soap maker a liberal supply of alkali of a consistent quality and thus contributed largely to the development of the industry, whilst the researches of Chevreul[17] in 1823 on the constitution of fats enabled the whole process to be placed on a quantitative scientific basis.

At the present time the soap production of Great Britain is estimated at about 500,000 tons per annum.

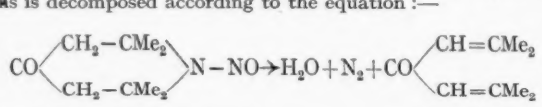
The subject of detergent action is, therefore, of immense importance and the possibility of greater economy in the use of soap and of utilising other materials of great interest, not only to the laundry and allied industries, but to the textile industry, where immense quantities are used in scouring and milling processes.

The Properties of Soap Solutions

Soap being the supreme detergent, the study of the properties of soap solutions is naturally an important item in the elucidation of problems connected with detergent action.

It was early realised that a purely chemical explanation of detergent action was not adequate, and the early workers, Chevreul and Berzelius, for example, attributed the detergent action of soap solutions at least partly to their emulsifying power. There was, however, a general idea that the hydrolysis of soap in aqueous solution was the main feature in the process, and the saponifying action of the alkali so liberated the chief factor. Indeed, prior to Spring's brilliant experiments, published in 1909, nearly all experimenters seem to have taken it for granted that greasiness was an inevitable characteristic of dirt and the reaction of soap with it an essential feature of all detergent action. The shortcomings of hydrolysis as a simple explanation of the detergent action of soap are, however, obvious.

The cleansing action of soap is much superior to that of a dilute solution of alkali alone, and the most highly dissociated soaps are not necessarily the best cleansers. It is evident, therefore, that detergent power is an inherent property of the soap solution as such. Apart, however, from objections such as these, the difficulty of obtaining quantitative data as to the degree of hydrolysis is such that it is only within the last few years that we have had reliable data upon which to justify or reject hydrolysis as the chief factor in detergent action. McBain and his collaborators, as a result of a laborious investigation of the conductivity of soap solution[5] and the rate of catalysis of nitrosotriacetonamine[6] which in the presence of hydroxyl ions is decomposed according to the equation :—



at a velocity proportional to the concentration of hydroxyl ions. As a result it was shown that the degree of hydrolysis was too small to be of any great effect in cleansing by means of saponification. The figures obtained for sodium and potassium palmitate were as follows :—

Gramme molecules per 1,000 gms.	Hydrolysis per cent.	
	Sodium.	Potassium.
1	0·2	0·08
0·5	0·37	0·63
0·3	0·50	0·63
0·1	1·28	1·25
0·05	2·22	2·02
0·01	6·60	6·80

In addition, McBain and his collaborators have collected a huge mass of data connected with the physico-chemical properties of the solutions of soaps made from pure fatty acids[2], as a result of which it is concluded that soaps are colloidal electrolytes[3, 4], in which one of the ions is a hydrated aggregate, the composition of which varies with temperature, the general formula being—$(NaP)_x\ (P)_n\ (H_2O)_m$, which may carry 10 electro negative charges and have a molecular weight of 3,000.

Experiments on Detergent Action

Referring to experiments more directly associated with the phenomena of detergent action, mention must be made of the following salient points :—

Hillyer[8] demonstrated the inadequacy of hydrolysis to account for detergent properties, and pointed out the importance of low surface tension as a factor in forming stable emulsions when once the particles of dirt had been coated with a film of solution. If the surface tension is low, the force tending to coalescence into drops is too weak to withdraw the films from around the particles, and consequently the system remains in the form of a stable suspensoid or emulsion according as the disperse phase is liquid or solid. Another important result of the low surface tension of soap solutions was the power of penetrating the capillary pores of the textiles.

The work of Spring[9] is particularly important in that he worked with materials carefully freed from fatty matter, and thus demonstrated experimentally that the presence of grease was not an essential in detergent action. He found that a lampblack suspended in water could be separated by filtration, but that on pouring dilute soap solution on the filter the black was carried through. Further, a suspension in water would settle in a few hours, whereas in 1 per cent. soap solution it remained in suspension for months. An important point in this work was the discovery of well defined optima in the concentrations at which the suspensions showed maximum stability. With ferric-oxide the optimum was about $\frac{1}{2}$ per cent. solution, whilst with alumina periodic optima were found at $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{16}$ per cent. A later investigation by Zhutsnov and Shestakove[16] showed that in actual laundry practice a concentration of about 0·3 per cent. gave the best results, whilst various authorities have recommended a similar concentration in milling woollen textiles.

An important contribution to the practical application of these scientific investigations was made by Jackson in his Cantor Lectures in 1908[9].

He showed that when immersed in soap solution the particles of dirt and loose fibres of the cloth were thrown into a state of oscillation or *pedesis*, and thus not only did the soap hold the matter in suspension but actually assisted in bringing it into suspension independently of the effect of heat or mechanical friction.

The action of soap in solution to oily matter was further elucidated by Pickering[1], who found that soap solutions actually dissolved relatively large quantities of oils such as paraffin and kerosene, the process being accompanied by an appreciable thermal effect which suggested that the action was at least partly chemical. Once dissolved, the combination was not broken by further dilution with water, though if a dilute soap solution were used the amount of oil actually dis-

solved was less, due probably to the formation of an emulsion in which the oil was protected from intimate contact with the soap. Incidentally, Pickering demolished the claim that the presence of naphthalene assisted the process of solution, the effect being to actually reduce the solubility.

The above is a brief outline of the classic investigations which have led us to the present position. It appears that the detergent properties of a soap solution depend largely to the degree in which it possesses the physical properties characteristic of the colloidal state.

At the same time, the phenomenon of hydrolysis, although not providing an adequate direct explanation of detergent action, is by no means negligible. The presence of free alkali in the solution assists in the emulsification by the formation of a soap with the oily matter of an acidic character at the adjacent surfaces. Shorter[16] found the drop number of benzene against water was greatly increased if a trace of oleic acid were added to the benzene and a trace of alkali to the water, but that the drop number against soap solution was not appreciably affected, hence it appears that the addition of a small amount of alkali to a neutral soap solution is of value, and other workers have shown that the addition of 1 per cent. caustic alkali has the effect of increasing the ease of emulsification.

The importance of surface tension is illustrated by the following figures :—

Surface Tension.	Typical Soap.	Lathering Quality.
Below 25	Sodium oleate	Very free.
25–27	Sodium linolenate	Free.
27–35	Tallow soaps	Poor.
Over 35	Hardened oil soaps	Very poor and lower the power of other soaps.

A further point in the variation of surface tension with concentration is illustrated by Myddleton's[10] figures, showing that the surface tension of solutions of sodium oleate passes through a minimum in the region of 0·2–0·3 per cent., which concentration is of the same order as that already mentioned as being of maximum efficiency in various industrial processes and that found by Spring to be of greatest power in stabilising his suspensoids.

Hydrolysis of Soap Solution

The question of hydrolysis has another claim to attention apart from the possible effects on surface tension and saponification. The hydrolysis of soaps occurs in stages. Thus, by successive grainings or salting out, sodium stearate yields a series of acid soaps of varying degrees of insolubility up to a tetrastearate, each being a sort of loose compound of molecules of neutral soap with molecules of fatty acid. The soaps of unsaturated fatty acids such as sodium oleate do not yield insoluble acid soaps at ordinary temperatures. In the case of the hardened oils which are now so largely used industrially the trouble due to this formation is serious, especially when the boiling process is used and the soap grained out, hydrolysis occurring, with the consequent formation of insoluble acid soaps of poor lathering power. This, however, does not occur when the cold process is used, in which the glycerine is left in the soap and only the unsaturated vegetable oils such as palm kernel nut oil are used. The presence of alkali is beneficial in tending to reduce the possibility of formation of acid soap.

Colloidal Properties

Jackson's observations on the phenomenon of *pedesis* have a considerable interest in relation to the process of "fulling" woollens and industrial processes generally. In "fulling" the fibres become interlaced, the fabric increasing in thickness at the expense of length and width. Under the microscope wool fibres show a series of barb-like projections which, once the fibres become entangled, make their separation impossible. This peculiarity to some extent accounts for the property of fulling for fibres of wools without these projections and chlorinated wools can only be fulled with extreme difficulty. It would appear that soap solution, by assisting, if not actually inducing, movement of the individual fibres, assists the process.

Absorption phenomena are particularly important in considering the effect of washing processes on fabric. It is found that wool in particular absorbs alkali from soap solution, whereas the acid soap is left in the water; as much as 0·28 per cent. is retained even after rinsing, since wool is particularly sensitive to the action of alkali: the importance of safeguarding against this is evident. The use of oleate soaps in this connection is, therefore, advisable both on account of the fact that they exhibit colloidal properties even in very dilute solution and show the least tendency to hydrolyse and deposit acid soaps.

In the case of linen and calico the absorption of alkali during washing is also marked, about 0·1 per cent. being found even when rinsing has been continued till the rinse water is neutral, whilst after twenty washings the mineral matter may have accumulated to the extent of 3·5 per cent. The use of acid or "sour" rinse, which is used so exclusively in American laundry work, and to an increasing extent in England, is, therefore, based on sound principles, though unless used with care it is quite possible to do more harm than good.

Detergents other than Soap

The use of other materials than the soaps of fatty acids is frequently advocated, and though in many cases the arguments advanced in favour of their use are little better than excuses for adulteration there are some cases that merit attention.

Rosin Soaps.—Ordinary rosin or calophony consists almost entirely of free acids, generally termed abectic acid, of which several isomeric forms exist (11). It is very easily saponified, and being cheaper than fats its use is naturally of interest to the soap maker and to the user. It possesses the advantage of giving a firmer soap, which prevents the bar going to pieces when used in rubbing on clothes, but when present in more than a moderate proportion causes stickiness.

Various maximum limits have been suggested. The makers appear to consider 10 per cent. a reasonable limit, but in laundry practice it is found that as little as 5 per cent. will cause a perceptible yellow tinge in white goods after repeated washings. The physical properties of rosin soap have been examined by several investigators. The effect on surface tension appears to be about equal to that of the soaps of fatty acids, and its presence to the extent referred to above increases the lathering power of commercial soaps to some extent.

Sodium Silicate has of recent years been largely used. It has several advantages from the manufacturer's point of view. It is cheap, and a fine attractive-looking bar can be produced containing less true soap than otherwise would be possible, whilst owing to its power of increasing the rate of setting the process of manufacture is expedited. An excessive quantity, however, causes the bar to crack and become distorted in course of time. As to its detergent action many contradictory statements have been made. This appears to be due to the fact that the commercial article varies considerably in the ratio of Na_2O to SiO_2 rather than to any bias on the part of the investigators. It appears from the work of Stericker (12) that the greater the proportion of silica to soda the greater the emulsifying power, a sample of the formula $Na_2O.3.3\ SiO_2$ being about equal to sodium carbonate in emulsifying mineral oils which contained a trace of free fatty acid. Used in conjunction with soap, a mixture containing 0·4 per cent. soap and 0·1 per cent. silicate was found to be equal to 0·5 per cent. soap free of silica, and its presence in small quantity tended to stabilise the latter formed by soap solution. In this connection the drop numbers obtained by Richardson (13), using a silicate of the formula $Na_2O\ 2{\cdot}83\ SiO_2$ are of interest :—

Solution containing	Drop number.
Pure water	13·5
0·25 per cent. silicate	13·5
0·25 per cent. soap	56·0
0·25 per cent. soap+0·25 per cent. silicate	91·0
0·20 per cent. soap+0·05 per cent. silicate	48·0

It is evident that, though Richardson's silicate had a lower ratio of silica than that advised by Stericker, the effect is to lower the surface tension of a soap solution though apparently it had little or no effect on that of water alone. It is to be noted, though, that the ratio of soap to silicate was in all these experiments much higher than the 1 per cent. limit recommended by the American launderers as permissible in bar soap, and consequently this work must be regarded as justifying the use of sodium silicate as an independent addition to the wash bath rather than as an ingredient of a bar of soap.

As a result of practical trials, Stericker concluded that it could be used with advantage in conjunction with soap and in some cases replace it entirely. There is considerable need for further investigation before the exact nature of the effect of sodium silicate can be properly understood. It is to be remembered that, though the determination of drop numbers may

provide useful information in comparing detergents of the same class such as the soaps of fatty acid, it is not justifiable to use them too freely as standards of comparison between detergents widely separated in their chemical origin and composition. It is to be hoped that the recently founded Research Association of the British Launderers' Federation will see its way to attack this question of the properties of detergents such as sodium silicate, for, quite apart from the ultimate judgment on them, the investigation cannot fail to help in establishing the relative importance of the various chemical and physical properties which go to make up detergent power.

Recently experiments have been made on the use of the hydrogenated products from benzene and naphthalene. Of these, hexaline and methyl-hexaline are favourably reported upon by several German writers.[14] It is stated that an addition of 10 per cent. not only prevents the deposition of acid soaps and thus increases the possibility of using hydrogenated oils, but also of insoluble lime and magnesia soap which are the cause of much trouble in laundry work, even when the water is softened to 5 degrees of hardness. It is also stated that the sodium salt of sulphonated tetra-hydro-naphthalene known as tetraline-soda-sulphite is capable of acting as a detergent alone, in many ways resembling the true soaps. Further results will be awaited with great interest.

Conclusion

It will be seen from the above brief outline that during the last decade there has been a great increase in our knowledge of detergents. It is not possible to regard detergent power as a simple property, but rather as the net result of several chemical and physical properties, many of which are capable of exact definition. The materials used are in many cases extremely complicated, and although the application of physical chemical methods has proved so valuable, it is necessary to point out that chemical methods cannot be ignored. Several important investigations in the realm of physical chemistry have proved of little permanent value owing to the absence of exact data as to the chemical composition of the materials. Even Hillyer omitted to publish the analysis of his sodium silicate, and several investigations have been made with what is merely described as good commercial grade soap.

In this respect the brilliant work of McBain and his pupils stands out pre-eminent in its scrupulous attention to details. Although such methods may seem laborious and far removed from the rough and practical world of industry, they yield certain and sure results and ultimately prove lasting contributions both to pure science and to industry. Indeed, the study of detergent action has proved as valuable in advancing purely scientific knowledge as it has been useful to industry, enabling the investigator to test existing theories and apprehend more clearly the significance of the vast mass of physical and chemical constants which has been so laboriously compiled in the fascinating branch of chemistry generally known as colloid chemistry. In no other branch is it so easy to be duped by phrases and formulæ, and consequently the contact with industrial problems in which ideas must be definite and crystalline is of the greatest benefit to the science.

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Industrial Uses of Hydrogenated Oils

By W. W. Myddleton, D.Sc.
(*Lecturer in Chemistry, Birkbeck College, London.*)

Many industries find the solid fats of greater value than the liquid glycerides. For these industries there has been opened up within recent years a vast supply of raw material in the form of synthetic fats prepared in a simple manner from the liquid oils. The process of hydrogenation is effected by stirring the oil with a small amount of a finely divided catalyst containing nickel, while hydrogen is passed through under carefully regulated conditions of temperature and pressure. *For references in text see page 450.*

Such unpromising material as the fish oils with their characteristic odour and taste can be converted by hydrogenation into almost odourless and tasteless white products, varying in consistency, according to the duration of the treatment, from that of lard to that of the completely saturated hard tallow melting at a temperature as high as 70° C. The synthetic fats have found important application in the preparation of edible products such as chocolate fats and margarine, in the manufacture of soap and candles, in tannery practice and dressing of patent leather.[1] Hardened castor oil is used as an insulating material for electrical purposes,[2] and treated cotton-seed oil is said to impart a matte finish to paint compositions.[3]

It must not be supposed that the utilisation of these fats in the various industries is as straightforward as in the case of the natural tallows. The fact is that the artificial tallows differ from the natural article in chemical composition, and if we are to understand the problems arising in the attempt to replace the natural by the artificial we must find out exactly wherein the difference lies. To demonstrate this point a sample of cotton-seed oil whose iodine value was 102·9 was saponified. The fatty acids were isolated and separated into solid and liquid components by the lead-ether method described by Lewkowitsch. The solid portion, representing 25 per cent. of the mixed acids, was identified as palmitic acid. The liquid portion consists of oleic and linolic acids in quantity representing approximately 31 per cent. and 44 per cent. respectively of the total mixed acids. A quantity of the oil was hydrogenated in the presence of a nickel catalyst at a temperature of 180° C. until the iodine value was reduced to 51·9.

Assuming for the moment that during hydrogenation the combined linolic acid is first converted into oleic acid and that stearic acid then appears, an assumption that is approximately true,[4] we arrive at the conclusion that the mixed acids obtained by saponifying the hydrogenated oil should contain 40 per cent. solid acids, the fall in iodine value accounting for the conversion of the whole of the linolic acid into oleic, and thereafter the production of 15 per cent. stearic acid. When the mixed acids were separated as before, the solid portion was found to form 65 per cent. of the whole.

A considerable amount of hardening had been effected therefore without absorption of hydrogen. It follows that the solid acids after hydrogenation must contain a new type of acid—solid but still unsaturated—and should exhibit a considerable iodine value. The iodine absorption was actually 33·8 per cent. This figure at once distinguishes the hardened product from the natural tallow. C. W. Moore[5] has effected the isolation of the new acids of hydrogenation from a partially hydrogenated ethyl oleate, and has shown them to consist of a mixture of elaïdic with a new acid isomeric with oleic acid, having the double bond in a different position along the carbon chain. It must be noted that the new acids of hydrogenation vary in character according to the nature of the oil used; they may, for instance, be isomeric with palmitoleic or with erucic acid if these acids are present or are produced in the oil during hydrogenation. The origin of the acids does not

at the moment concern us, so that we may consider their special properties, and the modification they bring about in the properties of the synthetic tallows. It is the practice to interrupt the process of hydrogenation before it runs to completion, since the later stages are somewhat slow, so that the new acids of hydrogenation escape complete hydrogenation and invariably occur in the commercial product.

The fish oils commonly contain moderate amounts of unsaturated acids possessing twenty or more carbon atoms in the molecule. After partial hydrogenation of these oils the new solid unsaturated acids are accompanied by behenic and higher members of the saturated series. This type of fat therefore differs widely from the natural tallow.

Food Value of the Synthetic Fats

The average human being requires a daily ration of food which will supply about 3,300 calories of heat energy, and of this nearly one-third is normally contributed by fats. The digestibility of synthetic fats is, therefore, of great importance. The digestibility of a natural fat is fairly well indicated by its melting point; hard fats melting above 50° C. are absorbed to the extent of about 10 per cent., whereas soft ones, such as lard, have the maximum digestibility of about 97 per cent. Authorities generally regard a melting point of 43° C. as a maximum limit for a good edible fat.

This applies also to mixtures, so that if a hard fat is incorporated with a soft one to produce a composition of average melting point, digestion proceeds satisfactorily.

It has been shown that the natural fats commonly employed in margarine manufacture are satisfactorily absorbed.[6] A feeding experiment carried out in Germany on 250 people under medical observation showed that a diet containing 23 per cent. hydrogenated whale oil was normally assimilated and no deleterious effects were noted.[7]

Presence of Nickel

The effect of nickel upon the human organism has been studied closely. It has been shown that nickel taken in small amount is almost completely excreted, and that as much as 0·5 grammes per day (in terms of oxide) can be taken without ill effect.[8] The hardened fats have a maximum reported nickel content of 6 milligrammes per kilogramme, and in fact most modern products contain no detectable amount of the catalyst. Food cooked in nickel vessels has been reported to contain from 16 to 107 milligrammes of nickel per kilo.[9]

Ability to Replace Natural Fats

In spite of what has been said the synthetic fats cannot completely replace the natural products. The question of the mechanism of nutrition has acquired a new interest in the discovery that in addition to a sufficient supply of food for the material renovation of the organism and the supply of energy, certain substances provisionally described as vitamins are essential if the body is to utilise efficiently the food supplied. These exist in minute amount in animal fats and oils (with the apparent exception of lard) but are apparently destroyed during hydrogenation. They are not present in the vegetable oils and fats.[10]

In the present state of our knowledge it is not possible to determine the minimum vitamin content of a fat which is to be regarded as a complete substitute for a vitamin-containing animal fat. It does not seem essential to insist that vitamins shall be present at all, since a sufficiency can apparently be obtained in other items in the normal diet.

In the light of the discovery of Miura and Zilva[11] that cod liver oil shows a vitamin activity from 40 to 230 times greater than butter fat, it would seem that the incorporation of small amounts of such a substance would remove the last reproach from the synthetic fat as a staple food.

Chocolate Fats

As far as physical properties are concerned cocoa butter is ideally suited for use as a chocolate fat; it melts at a temperature of about 33°C. and can be cast into any desired shape to form a hard, homogeneous, but not too brittle mass. It is, however, expensive; and its digestive properties leave much to be desired.[6]

As a complete substitute for cocoa butter the synthetic fats have the drawback of setting to a heterogeneous mass, and unless the melting point is rather high they do not cast well. The heterogeneous setting may be inhibited by the addition of the requisite amount of a natural fat containing the glycerides of myristic or palmitic acid in fair quantity. Cocoa butter itself may be used for the dilution since it contains approximately 19 per cent. palmitin. Other diluents of the same type suggest themselves, but whatever the added substance may be, it must be remembered that the melting point of the mixture is not the mean of those of the separate fats. It is probable that the addition of hydrogenated maize oil would improve the casting properties since this substance expands considerably on setting.[12] It may be found advantageous to convert a portion of the hydrogenated glycerides into di-glycerides by suitable treatment with glycerine[13] although again the possible influence upon the melting point must not be overlooked.

Margarine

The influence of the new acids of hydrogenation, and of the higher saturated acids in the hardened fish oils is commonly revealed in the spotted appearance of the emulsified product, and in the separation of hard granules during its use for cooking purposes. The remedies suggested in the case of chocolate fats would also apply here.

Brauer asserts[14] that margarine containing synthetic fats tends to retain excessive amounts of moisture, and if this is the case (it is disputed by some workers) the fault is probably due to a heterogeneous setting which might be modified as suggested above.

Candles

It has been pointed out[15] that even in candles prepared from natural tallow acids it is necessary to preserve a balance between the amounts of stearic acid and palmitic acid in the mixture. If this adjustment is not made a coarse crystalline structure is the result, and the finished candle lacks transparency and ring, and is inclined to crack and break. These faults have been remarked in the case of candles prepared from synthetic tallow acids[16] and they are, if anything, more pronounced. It is obvious that if the mixed acids derived from a hardened oil crystallise in a coarse form it will be impossible to express the oleine freely, and a low melting product will be the result. The admixture with palmitic acid before seeding for expression thus serves the double purpose.

Soap

The detergent action of a soap is closely related to its power of forming stable emulsions with the greasy matter accompanying dirt, and with its power of forming a lather or foam, which may be regarded as an emulsion between the soap solution and air. Both of these properties are in turn related to the surface tension of the solution and to the superficial viscosity of the surface layer in which the soap is concentrated according to the well-known rule of Willard Gibbs. In true emulsion formation the part played by surface viscosity is considerable, but in foam formation it is of minor importance. The amount by which a soap lowers the surface tension of the water in which it is dissolved is an excellent criterion of its detergent power.

The sodium soaps of the liquid fatty acids, oleic, linolic and linolenic, produce the maximum lowering of surface tension, and with these may be classed the soaps of the nut oil fatty acids.

The new acids of hydrogenation must be classed with palmitic and the higher saturated fatty acids since they have a surface tension effect much less than that of the liquid acids. With respect to surface viscosity, too, the new acids are akin to the palmitic type, producing solutions with highly viscous surface layers, but as against this presumably good feature, we have developed the tendency to produce insoluble acid soaps by hydrolysis and the solubility of the soap itself is diminished. We see the influence of the deleterious acids produced during hydrogenation reflected in the properties of the soaps made from the synthetic fats.

The technical literature is full of complaints,[17] but it must be said that the hydrogenated products are not without their champions.[18] The consensus of opinion is that as a complete substitute for the natural fats the artificial products are not satisfactory. The soaps they yield :—

1. Are less soluble than those of the natural tallows;
2. Readily form insoluble acid soaps by hydrolysis;
3. Are poor in surface tension action;
4. Do not lather freely, and have poor detergent action;
5. Possess a characteristic odour incompatible with many perfumes.[17]

The remedies suggesting themselves are numerous. It seems impossible to remove the new acids of hydrogenation

when once formed, and if it were possible to prevent them from appearing we should still have to deal with the saturated acids of high molecular weight in hardened fish oils. The most hopeful method of masking the action of the deleterious constituents is to add a carefully chosen acid or mixture of acids to the hydrogenated product so as to form an "eutectic surface tension mixture."

The lowering of surface tension produced by a mixture of soaps is not generally the mean of the lowering effected by the separate soaps; it is often much greater. It is in many cases possible to enhance the action of soaps made from artificial tallows by adding moderate amounts of other soaps derived from liquid acids or from nut oil acids. In all cases, even when natural fats are employed, it is important to preserve a balance between the amounts of liquid and solid acids in the soap mixture. For the best all-round results the ratio is approximately 50 : 50. The new acids of hydrogenation rank, of course, as solid acids and cannot function as their liquid isomers of identical iodine value.

Sufficient has been said to make it abundantly evident that before the synthetic fats become firmly established as complete substitutes for the natural tallows, greater consideration must be paid to the composition of the synthetic product. A thorough analysis of the fats must be made part of the laboratory routine, since the amount of the deleterious acids produced during hydrogenation is not constant for a given reduction in iodine value, even when the raw material is the same.

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The Analysis of Margarine

By G. D. Elsdon, B.Sc., F.I.C.

The writer gives an interesting survey of the methods employed for detecting the presence of the various ingredients utilised in the manufacture of margarine. In addition, he raises an important point in connection with vitamin content, and contends that no butter substitute can be considered satisfactory from the nutritional standpoint unless it contains a reasonable proportion of beef fat or butter.

THE analysis of margarine may be divided roughly into two sections—the determination of the various ingredients, water, salt, preservatives, milk solids, etc., and the examination of the composition of the fat—*i.e.*, the determination of the various oils and fats which have been used in the manufacture. In a short article it is not, of course, possible to go into full practical details on any one of these points, and even to cover the whole ground superficially would require more space than is at present available. It is proposed, therefore, to confine these remarks almost entirely to the second of the above-mentioned sections.

The chemist who has had only a small experience of fat analysis, the one for whom these notes are primarily intended, must be warned that although at times the problem may be comparatively simple, yet, owing to the increasing number of oils that are being placed on the market suitable for margarine manufacture, the matter is becoming more and more complex, and frequently it is only possible to state the particular class of oil which has been used, leaving the actual member of the class more or less unidentified. The difficulties are further increased by the somewhat wide variation in the composition of natural products; thus although two different oils may have quite distinct analytical figures if they are of average composition, yet, slightly abnormal oils may approach each other in composition to such an extent as to make identification difficult if not impossible. For the determination of the approximate composition of a mixture of oils and fats it is necessary, therefore, to assume that each constituent has an average composition. As a general rule this is a legitimate assumption and one which does not lead to serious error. From the above remarks it will be seen that it is not infrequently impossible to detect admixture with oils where the amount of any one of the ingredients falls much below 10 per cent., except where a colour test is available or where, as in such cases as butter or arachis oil, some characteristic and easily determined glycerides are present. This fact is not, however, of very great importance; it merely suggests caution in the interpretation of analytical results, especially in the hands of the inexperienced.

Margarines fall into two main classes, those in which animal fats are the chief ingredients—oleomargarine, and those in which the main portion consists of such fats as those of the coconut family—vegetable margarines. The following may be taken as suggestive of these two varieties, the composition varying with the season. Some Continental margarines contain at least 10 per cent. of sesamé oil; this is on account of legal enactments, the idea of which is to earmark margarine. The same purpose is achieved in other countries by the use of starch, phenol phthalein or other dye.

Oleomargarine.		Vegetable Margarine.	
Lard	20	Animal fat	15
Oleo	55	Coconut oil.. ..	65
Vegetable oil ..	25	Arachis oil	20

The vegetable oils widely used in the manufacture of margarine include arachis, coconut, cottonseed, linseed, palm kernel, rape, sesamé and soya bean, besides which there are others such as palm oil, sunflower oil and maize oil which are being used in increasing quantities. New supplies of oil-bearing seeds are continually being exploited in tropical countries, any one of which may, in time, be imported on the commercial scale.*

The fat may be prepared for examination by melting a suitable portion (say 30 grams) in a small beaker and filtering through a coarse filter paper (Whatman No. 4 is quite suitable) standing in a warm place; convenient portions of this may then be removed for the various tests as required. It is a convenience to have a pipette graduated to deliver five grams of melted fat. Such a pipette may be made by taking a "short form" 5 c.c. pipette with the mark low down on the stem and re-marking it so that it delivers 5·80 grams of water at 15·5° C.

Chemical and Physical Tests

Chemical tests give very much more information than do physical ones, yet of these latter the melting point and refractive index are important and should not be omitted. The first of the chemical tests to be applied should be the Reichert-Meissl, using the glycerol modification of Leffmann and Beam so that the Polenske and Kirschner extensions may be carried out subsequently. The Shrewsbury and Knapp method may be used with advantage employing the modification suggested by the writer † on the residue from the Reichert distillation.

Analyst*, 1915, **40, 3; 1917, **42**, 35.
†*Analyst*, 1917, **42**, 298.

The great advantage of this process is that it gives a measure of the two characteristic acids of the coconut oil group (lauric and myristic), which, together constitute some 65 per cent. of the acids of this group of oils; it gives, moreover, almost identical results with palm kernel and coconut oils.

The amount of butter and coconut oil present may be calculated by means of the following formulæ, which are based on the publications of Cribb and Richards* and Arnaud and Hawley†.

If R=Reichert Number, P=Polenske Number, K=Kirschner Number,

$$\text{Percentage of coconut oil} = \frac{P + 1{\cdot}5 - R/10}{0{\cdot}176}.$$

The correction of 1·5 is to allow for the Polenske due to a margarine fat free from butter and coconut products, usually about 0·4 and also for the solubility of the "insoluble" acids of coconut oil in the soluble Reichert acids. The correction due to the latter is 1·9 except in those cases where the Polenske value is less than 2·5, when the actual correction may be taken from the curve due to Arnaud and Hawley (*vide supra*). Using the Reichert value the percentage of butter may be calculated from the following formula:

$$\text{Percentage of butter fat} = R - 2{\cdot}2 - \frac{(0{\cdot}065 \times \text{percentage of coconut oil})}{0{\cdot}29}$$

The correction of 2·2 is obtained in a similar manner to the above, using 0·3 as the Reichert value of a normal margarine base free from coconut oil.

The percentage of butter, especially where only small quantities are present, is determined with considerably greater accuracy from the Kirschner value using the following formula:

$$\text{Percentage of butter fat} = \frac{K - 0{\cdot}3 - P/10}{0{\cdot}23}$$

The percentage of coconut oil as determined by the Polenske process should be compared with that determined by the modified Shrewsbury and Knapp process. In those cases where there is a material difference between these figures a proportion of some oil analogous to coconut oil is indicated—probably palm kernel oil, although the use of oils such as Babassu is becoming more general. The figure obtained by the Shrewsbury and Knapp method should be accepted as the true indication of the total amount of coconut group oils present and the actual proportion of coconut oil to palm kernel oil may then be calculated from the Polenske value. This figure may be checked by the method due to Burnett and Revis‡ and by the methods of Blichfeldt§ and of Stokoe¶ depending upon the melting point of the Polenske fatty acids.

The distillation method due to Blichfeldt** has obtained a certain amount of favour in margarine works in this country, and it may be used in doubtful cases as a check on the results obtained by the Polenske-Kirschner process, but the results obtained by this process are not as conclusive as those obtained from the combined Reichert-Polenske-Kirschner process. It has the advantage, however, of only requiring one distillation as against the two required in the Kirschner process, but this advantage is outweighed by the somewhat cumbersome technique involved. To a worker who has come to look upon the Reichert process and its extensions as one of the most valuable methods available for the examination of oils it is, perhaps, somewhat difficult to pass an unbiassed opinion, but certainly, in the opinion of the writer, the Blichfeldt process offers no advantages over the former and, moreover, as has been pointed out above, suffers to a certain extent by comparison. The Blichfeldt process would have been of great value had it been the only one available, but it is not now likely to supersede the older and somewhat more valuable Reichert process.

The percentage of butter and coconut oil having thus been established it is necessary to proceed with the determination of the other constituents. The iodine value and the refractive index should first be determined. The amount of butter fat and coconut oil present being known, the calculated values for these may be substituted and the values for the remainder of the oils present thus determined. Vegetable oils will have higher iodine values than animal oils, whilst the presence of vegetable oils will be confirmed by the high refractive index, after taking into account any coconut oil which may be present.

Analyst, 1911, **36**, 372. §*J.S.C.I.*, 1919, **38**, 150T.
†*Analyst*, 1912, **37**, 122. ¶*J.S.C.I.*, **40**, 57T.
‡*Analyst*, 1913, **38**, 255. **J.S.C.I.*, 1910, **3**, 792; 1919, **38**, 150T.

The saponification figure is occasionally useful, but as a general rule any information so obtained can be deduced from the other usual tests.

Animal Fats

The presence of animal fats may be detected within limits by comparing the sample with mixtures of known composition by means of the following test:—3 c.c. of the fat are run into a 25 c.c. cylinder and dissolved in 20 c.c. of ether, by gently warming if necessary. The cylinder is then lightly stoppered with cotton wool and allowed to stand. When a deposit of crystals has taken place their appearance and volume are observed and the volume of the ether is measured. The crystals are then removed and examined microscopically, and, if possible, their refractive index taken. Where positive results are obtained the Stock-Belfield method should be employed. The method, however, although probably as good as any that will be devised, and capable of giving valuable information in experienced hands, is one that requires much time and care. The microscopic character of the crystals obtained is of the greatest importance, but great care must be taken during crystallisation or the type of the crystals obtained may be altered. It has been suggested that a determination of the stearic acid present in the fat by the method of Hehner and Mitchell will be of assistance in the detection of animal fats. In some cases this undoubtedly is true, but the method is inclined to give widely fluctuating results, so that the trouble involved will only be justified in cases of extreme difficulty, or where it is particularly desirable that the composition of the margarine be given as fully as possible. In the case of mixtures of fats containing little stearic acid arachis oil may be detected and determined by means of Ever's modification of Bellier's test*, this, however, cannot be done in the presence of animal fats or oils containing stearic acid, as this will be largely precipitated along with the "arachidic" acid.

The presence of cotton seed oil, sesamé oil, etc., may frequently be detected by the appropriate colour tests. These tests are liable, however, to various sources of error and the information obtained therefrom, though frequently of great value, must be treated with a certain amount of reserve. Modern methods of refinement tend more and more to reduce the intensity of the reactions given by the pure oil so that a negative reaction does not of necessity mean that the particular oil in question is absent. On the other hand, fats from animals which have been fed on various oils or oil cakes have a tendency to give the colour reactions of the oil in question; the reaction is, usually, however, slight, and will not introduce any very great error. The possible presence—in fact, as time goes on, the likely presence—of "hardened" or "hydrogenated" oils must not be overlooked. At present it is difficult to detect these chemically by direct methods, but the amount of stearic acid present should afford a valuable clue. At first it was possible to trace the presence of hardened oil by detecting the minute amounts of nickel, used as a catalyst in the process of hardening, left in the oil, but at the present time many hardened oils are on the market which do not give any reaction for nickel, either because the whole of the catalyst has been removed (as is now possible) or because some other catalyst has been used. Although a negative result for the presence of nickel must not be considered conclusive the test should not be overlooked. It is due to Atack† and is carried out as follows:—Heat as large a quantity as possible of the fat with an equal bulk of concentrated hydrochlorid acid in the water bath with frequent shaking for at least an hour. Separate the acid layer and evaporate to dryness in a porcelain dish on the water bath. Dissolve the residue in about 50 c.c. of hot absolute alcohol, make slightly alkaline to ammonia and add 50 c.c. of a hot saturated solution of α-benzildioxime in absolute alcohol. A red precipitate indicates nickel. The precipitate may be filtered off and weighed; the weight of nickel being the weight of precipitate multiplied by 0·1093.

For the purpose of the Food and Drug Acts it will not be, necessary, in general, to carry out more than a portion of the work indicated above. The determinations usually necessary are:—(1) Water; by heating two grams of the well and carefully mixed sample on the water bath until constant in weight. The amount should not exceed 16 per cent. (2) Boron preservative; by washing 6·2 grams of the melted fat carefully in a separator with hot water and titrating the boric acid in

Analyst, 1912, **37**, 487. †*Analyst*, 1913, **38**, 316.

the aqueous liquid in the presence of glycerol as usual. There is no legal standard, but a Departmental Committee suggested not more than 0·5 per cent. calculated as boric acid. (3) Butter fat; by the Reichert-Polenske-Kirschner process. The percentage of butter fat should not exceed ten per cent. From time to time it is necessary to make other determinations, but for routine work the above are usually all that are necessary.

The following table due to Clayton (*Margarine*, page 114) will assist in the elucidation of the composition of samples of margarine. The first table gives the composition of eight mixtures of fat prepared in the laboratory; the second table gives the analytical figures which were observed for these mixtures.

TABLE I.

Fatty Constituents.	A %	B %	C %	D %	E %	F %	G %	H %
Butter fat	—	10	—	—	—	10	10	—
Oleo	55	50	—	30	—	—	—	60
Premier jus	—	—	—	10	15	—	—	—
Coconut oil	25	25	50	25	15	70	35	—
Palm kernel oil	—	—	30	—	50	—	35	—
Cottonseed oil	10	5	—	20	20	20	20	10
Ground-nut oil	—	—	20	—	—	—	—	—
Lard	—	—	—	15	—	—	—	30
Hardened whale oil	10	10	—	—	—	—	—	—

TABLE II.

Analytical Value.	A	B	C	D	E	F	G	H
Reichert-Meissl No.	2·7	5·9	5·6	1·5	4·2	8·9	7·4	—
Polenske No.	4·6	4·8	12·0	3·2	9·1	11·4	9·3	—
Kirschner No.	0·8	2·7	1·5	0·5	0·8	3·7	3·7	—
Total Blichfeldt No.	5·3	8·2	14·6	5·2	10·0	17·7	15·1	—
Soluble Blichfeldt No.	0·8	3·2	2·2	0·8	1·9	4·9	4·6	—
Insoluble Blichfeldt No.	4·4	4·9	12·4	4·4	8·1	12·8	10·5	—
Saponification value	212·0	214·3	242·7	210·0	234·0	242·0	234·0	198·0
Iodine value	47·7	42·2	29·1	56·1	34·1	32·2	34·0	55·6
Refractive index at 40 C.	46·0	46·0	40·0	46·8	43·0	40·0	40·8	49·3
Melting-point	27·3	28·8	20·7	23·6	24·8	20·5	21·8	28·0
Halphen test	++	+	—	+++	+++	+++	+++	+
Belfield test. Beef	+++	+++	—	+++	+++	—	—	+++
Belfield test. Lard	—	—	—	+	—	—	—	++
Nickel test	+	+	—	—	—	—	—	—

Even a short account of the examination of margarine would not be complete without a reference to the presence of the vitamin, fat-soluble A. This substance is necessary for proper nutrition and is present in relatively large amounts in butter, to a lesser degree in beef and mutton fats and is entirely absent from lard, vegetable oils and hydrogenated oils. From this point of view, therefore, all margarine should contain a reasonable proportion of beef fat and/or butter and no butter substitute can be considered satisfactory from the nutritional standpoint which does not do so.

The Manufacture of Olive Oil

Olive oil is one of the most valuable and interesting of vegetable oils. Its record goes back to the earliest days of the human race, and its beginnings are shrouded in the mists of antiquity, for it was doubtless one of the first articles of merchandise to be traded in by mankind. To countless thousands of small farmers in the south of Europe to-day it is their main source of wealth. Their whole lives are centred in their olive orchards, and the olive harvest dance is among the most important events in their calendar.

THE total world production of olive oil has been estimated at nearly 1,000,000 tons, but this is, perhaps, somewhat exaggerated. According to the table given below by an eminent French authority, the total in 1920, which was a good year, was 807,000 tons, and in 1921, which was an "off" year for most countries except France, the total was 510,000 tons:—

	1920. Tons.	1921. Tons.
Spain	325,000	250,000
Italy	210,000	110,000
Greece	50,000	20,000
Portugal	35,000	20,000
Tunis	70,000	50,000
Algeria	15,000	10,000
Morocco	12 000	6,000
France	10,000	20,000
Others	80,000	24,000

The other countries include Turkey, Syria, Cyprus, Crete, California and South Australia. Production is probably increasing in most olive countries with the possible exception of France, and strenuous efforts are being made to extend and improve its cultivation in France, and the Colonial Institute at Marseilles is doing some useful work in this direction. It would seem also that its cultivation could be considerably extended with great advantage in the British Empire; and, as a matter of fact, it has been introduced with great success in South Australia, where it has now been flourishing for some years, and, more recently, in South Africa. Strangely enough, however, it has not succeeded very well in India up to the present. Of other countries outside the Mediterranean basin, California is the most important, and here, too, notwithstanding the best scientific methods of cultivation, it has not been found possible to produce oil of the very best quality, and the U.S.A. imports its best oils from Europe. By far the greater part of the oil produced is consumed in the producing countries, and compared with the total production the export trade is not large. The exportation of olive oil, in fact, especially of late years, has been purposely restricted, if not altogether prohibited, by the producing countries. But as production gets back to its pre-war level, and beyond, these restrictions will doubtless be removed. Few countries in Europe, in their present financial condition, can afford to limit in any way their export trade. The imports of olive oil into the U.K. during the last three years have been: 1920 2,527 tons; 1921, 2,342 tons; 1922, 4,984 tons. During the first two months of 1923 the imports have amounted to 833 tons, and if this rate is maintained it will approximately equal the 1922 figure.

The Cultivation of the Olive

Since its favourite *habitat* is the Mediterranean basin, we may conclude at once that the olive prefers a sub-tropical climate not too far from the coast; and it also likes a soil which is not too rich or moist. It frequently does well on a comparatively poor soil, on the sunny slopes of the hills in South Europe, if other conditions be favourable. Although it can be propagated from cuttings or by layering, the best results are almost invariably obtained from seed. Grafting is much practised by the best growers, and constant attempts are being made to improve existing varieties and evolve new ones. Already in Italy alone there are at least 30 different varieties. In the south of Europe it is not so much a question of starting new plantations as rejuvenating old ones; and owing to its very vigorous root system this is a comparatively easy matter. The old tree is cut down to the ground and new shoots spring up at the base, and of these, one, two, or three are left at the end of two or three years. These young growths may be grafted and new varieties thus obtained.

In Greece and the adjoining islands grafting the cultivated tree on the oleaster is a common practice; and in Italy embryonic buds, which form small swellings on the stems, are carefully excised and planted. These "uovoli" soon grow and form a vigorous shoot. In the East the olive plantations are much neglected, especially pruning, which is a very essential operation. Even in France, M. Bonnet, an eminent French authority, estimates that one-fourth of the olive orchards require renewal. Where the olive is carefully cultivated, as in Languedoc and Provence, it is planted in rows at regular intervals, the distance between the trees varying in different "olivettes" according to the variety grown. The spaces between the trees are occasionally manured with dung or other nitrogenous matter, and annual crops are often grown in between, but M. Bonnet strongly condemns this practice, and doubtless the trees are better without any intercalary cultivation. The same authority also combats the prevailing impression that the olive tree can only yield a good crop every alternate year. He contends that, with proper pruning and manuring, the "off" year need only occur once in every five or six years. A dwarf variety was introduced some years ago. It is very prolific and much favoured in certain localities, especially America, where it is said to have produced a crop two or three seasons after planting, whereas usually it takes five or six years. The following table gives results of some manuring experiments carried out by M. Bonnet: yields in kilos. per tree, size of plot 20 ares ('098 rood):—

1	2	3	4	5	6
Plot No.	Un-manured.	Green manure ploughed in.	Farm manure.	Artificial fertiliser.	Dung and Artificial.
1	6·400	16·850	17·600	18·300	19·500
2	1·100	1·460	4·0	3·650	6·220
3	15·200	20·500	27·500	24·600	30·600
4	21·960	39·500	36·760	32·000	38·000

The increases due to manuring, representing differences between columns 2 and 6 are, for the four plots in order: 13·100, 5·120, 15·460, and 16·040 kilos. The farmyard manure was applied at the rate of 50 kilos. per tree, and the artificial consisted of 0·8 kilos. ammonium sulphate, 1 kilo. superphosphate, and 0·4 kilo. of potassium sulphate or chloride. It does not appear very economical to apply farm dung and artificial both in the same season, and it would be a better and more usual practice to give them in alternate years. It is estimated that a medium yield of olives, say 12 to 15 kilos. per tree, removes from the soil per hectare per year—22 to 25 kilos. nitrogen, 22 to 25 kilos. potash, and 12 to 15 kilos. of phosphoric acid. No reference appears to have been made to the application of lime, and yet this would seem to be a valuable addition, especially as the olive prefers a calcareous soil. The olive suffers greatly in some years from the attacks of various enemies. A fungoid growth has at times infested the trees for several successive seasons, to the great damage of the plantations. A species of coccus, *C. oleae*, attaches itself to the shoots, certain lepidopterous caterpillars feed on the leaves, while the deadly "olive fly" (*mouche de l'olive*) attacks the fruit. Frost often does considerable damage, and gales cause the fruit to fall prematurely. For dealing with the olive fly, a mixture said to have been fairly successful in France consists of molasses, honey or glycerine, and sodium arsenite. It is applied in July, August and September. As a useful precaution against insect pests it cannot be too strongly urged that the utmost cleanliness must be observed in the oil-mills, combined with frequent disinfection.

The Manufacture of Olive Oil

An important point in connection with the manufacture of olive oil is the gathering of the fruit at the right time and in the proper manner. The fruits do not all ripen at the same time, and if all are gathered at once many of them have to be stored for a few days to ripen. For the very best quality oil the fruit is hand-picked just before it is quite ripe, then peeled and pressed slightly. But formerly it used to be the general practice to beat the fruit from the trees with long poles, and it is obvious that this is a very unsatisfactory method from the point of view of oil quality. Particular attention must be paid to storing, and the olives are best stored in shallow layers in a well ventilated storehouse, or sometimes in brine-water, and must not be allowed to sweat. The processes used in olive oil manufacture vary considerably from the most primitive to the most advanced methods of the large up-to-date mills. It is proposed to give here: (*a*) an abridged account from Lewkowitsch (6th ed.), which, by the way, is the same as that given in the 5th ed.; (*b*) the most up-to-date French method, as described by M. Bonnet; and (*c*) certain modifications recently suggested in a paper read at the Spanish Engineering Congress, by L. Luque.

(*a*) *Lewk., 6th ed.*—The olives are first crushed in a mill of the edge-runner type and then pressed in hydraulic presses two or three times, yielding the best cold-pressed oils. They are still somewhat turbid, and are improved by settling or washing and filtering. The repeatedly pressed pulp (*grignons*) still contains a considerable amount of oil, varying from 10 to 22 per cent. The pulp is now beaten up with hot water in special mills (*moulins de ressence*), and the oil cells are thereby further broken up. The ground mass, together with the water, is run into a series of vessels arranged in tiers where the water separates from the oil and broken cellulose tissue. The oil and the tissue rise to the surface, where they are skimmed off, whilst the heavier kernels fall to the bottom. The latter are known as *grignon marc blanc*. The emulsion of oil and tissue, known as *grignon marc noir*, is heated up and subjected to a fresh expression in a hydraulic press, the oil so obtained being known as *huile de ressence*, and the pressed residue as *tourteau de ressence* or *sanza*. The oil is passed into settling tanks and separates out into a clear oil above (*huile claire de ressence*) and a lower thicker layer (*pate de ressence*) or olive oil grease. In some establishments the marc, instead of being boiled up, is fermented in pits, the oil rising to the surface, and known as *huile d'enfer*. This name is also applied to oil which has settled out from the press waters after moistening and boiling the pulp, and which has been stored in underground cisterns. To this class of oil also belong the *bagassa* oils obtained from fermented marc, especially in Portugal.

(*b*) *French Practice, according to M. Bonnet.*—In addition to a preliminary crushing in a special mill (*concasseur*), without breaking the kernels, the crushed mass is further ground up in disintegrators into a very fluid pulp. This pulp is transferred to the press bags (*scourtins*), which are now mostly made of alfa, and these bags are piled up in a column of 23 or 25, or two columns of like number if a twin press is used, and placed in the press. Sheet iron plates are inserted in the column dividing the bags into three lots of about 8 each, and the total charge in each column is 120 kilos. The percentage of oil from the first pressing is 16 to 25 per cent., the pressure being about 60,000 kilos. One or two further pressings may be made up to 200,000 kilos. It was formerly a general practice to remove the kernels and crush these separately to obtain olive kernel oil, but there appears to be no great advantage in this. The liquor finally coming from the press consists of water of vegetation (*margine*) and oil, and owing to their difference in density they are readily separated by centrifuging, which gives far better results than the old method of settling or decantation. After the final pressing the residue is extracted with ethylene trichloride or carbon bisulphide, preferably the former, since there is greater security against fire and explosion. The residue is dried, placed in the extractor with the solvent, and heated for two or three hours. The solvent is then driven off, collected in a condenser, whilst the residue is steamed to remove final traces of solvent and cooled. In some experiments carried out at Nimes with ethylene trichloride the extraction was almost complete and the loss of solvent did not exceed 0·6 per cent. The dried residue may be used as fuel or fertiliser. When carbon disulphide is used the well known sulphur olive oils are produced.

(*c*) *Spanish Practice.*—After the first or second pressing the residue is broken up, mixed with hot water, and again pressed. The use of hot water, however, is undesirable, since this encourages fat-splitting by the olive enzyme, *olease*, and considerably increases the fatty acid content of the oil. The final residue still contains 6 to 15 per cent. of oil, and is extracted generally with carbon disulphide. There are in Spain about 350 oil mills, many of them of large size and thoroughly up-to-date and combined under one federation or syndicate. One large mill will deal with the produce of all the farmers in the district, and stringent regulations are imposed as to the quality of the fruit brought in.

In an interesting paper read before the Spanish Engineering Congress, Major Juan M. Luque made several important suggestions in connection with the manufacture of olive oil. Instead of two or three pressings one only should suffice, and the pressure should be gradually increased up to 125 tons. The residue should be at once dried and extracted with carbon disulphide, but if it should be necessary to store the residue, *e.g.*, in silos, then some preservative such as sulphur dioxide (sulphurous acid) should be added, or calcium bisulphite may be used. He also suggested various methods for dealing with the extracted residue for the production of potash and other products.

Historical

At what remote period of human progress the wild *oleaster* passed under the care of the husbandman and became the fruitful garden olive it is impossible to conjecture. It is frequently referred to in the Bible and Homer's *Iliad*, and all tradition points to the limestone hills of Attica as the seat of its first cultivation in Greece. By Solon's time it had increased to such an extent that laws were framed to regulate its cultivation, and Pliny refers to it as growing abundantly in Spain and the two Gallic provinces. In Egypt it did not flourish, and the olive oil found in the Theban tombs was probably imported from Syria. Along the southern shores of the great Mediterranean the tree was carried by the Phoenicians, at a remote period, to their numerous colonies in Africa, to southern Spain and Sardinia, and perhaps also to the Canary Islands. Yielding a grateful substitute for the butter and animal fats consumed by the races of the north, the olive, in the south, became an emblem not only of peace but of national wealth and domestic plenty; and of victory, too, forming the crown alike of the Olympic victor and the Roman conqueror. Among the Greeks and Romans the oil was valued as an article of diet as well as for external use. The unripe fruit, steeped in brine, was much valued, and pickled olives have been found among the buried stores of Pompeii. The bitter juice deposited during expression of the oil (called *amurca*, whence *marc* is derived) and the astringent leaves of the tree have many virtues attributed to them by ancient writers.

Centenary Celebrations of the British Alkali Industry

Liverpool Dinner : Works Inspection at Widnes

Extended reports are given below of the celebrations in connection with the centenary of the United Alkali Co., at Liverpool and Widnes, of which a preliminary notice appeared last week.

The Centenary Dinner

(From Our Special Correspondent.)

Liverpool, April 18, 1923.

The great gathering which assembled at the Adelphi Hotel here to-night to celebrate the centenary of the United Alkali Co. was representative of every aspect of British chemical industry and in every way worthy of a great occasion. Some general impressions appear in our editorial notes. Here it is sufficient to give an ordinary record of the proceedings. The guests were received by Sir Max Muspratt, the chairman of the company, and he presided at the centenary dinner. Among those present were the Lord Mayor of Liverpool; Sir Benjamin Johnson (High Sheriff); Colonel Sir E. Brotherton; Sir R. Salvidge; Major-General Thuillier; Mr. R. G. Perry; Lt.-Col. Sir J. Reynolds; Mr. J. Tennant; Sir E. F. Oldham; Mr. Roscoe Brunner; Dr. G. C. Clayton, M.P.; Sir John Cowan; Sir R. Threlfall; Sir W. J. Pope; Sir W. Alexander; Dr. E. F. Armstrong; the Warden of the Dyers' Company (Mr. J. A. Brewin); Sir A. Bicket; Mr. W. A. Tennant; Sir F. E. R. Becker; Mr. Robert Mond; Colonel W. H. Stott, M.P.; Sir Frederick Norman; Mr. W. J. U. Woolcock; Sir J. Turner; Mr. Holbrook Gaskell; Mr. Stuart Deacon; Mr. Clifford Muspratt; Sir Charles Mandleberg; Mr. Rudolph Muspratt; Mr. C. A. Hill; Dr. Levinstein; Sir James Ritchie; Mr. Percy Ashley (Board of Trade), etc.

The toast of "The King" was given by the Chairman, who also read a message from Lord Derby offering congratulations on the centenary of the company and on the wonderful contribution it had made to the prosperity of the country.

Chemical War Service

Sir Benjamin Johnson, in proposing "His Majesty's Forces," referred to the great part chemistry had played in the war and its importance to other national industries.

Major-General Thuillier, who was the director of Chemical Warfare Services in France during the war, in replying, spoke of the services which the chemical industry of Great Britain had given to the winning of the war. When the Germans introduced poison in the war they no doubt had confidence in the knowledge of the great chemical industry behind them that it would be a factor which would decisively achieve their victory. But they had not reckoned upon the enormous retaliatory development which ensued in this country. Great Britain produced and discharged upon the enemy twenty times the volume of gas which its troops had to endure. We produced 5,700 tons of liquid gas for cylinders, projectors, and trench mortars alone, not counting the great mass which was produced for the purpose of gas shells. This great volume of production was the outcome of the extraordinary energy, resourcefulness and skill displayed through all branches of the chemical industry. Various writers inspired with the gift of prophecy had predicted that when the next war came gas rained down from the air which would stupefy, intoxicate or infect with disease would be the only weapon employed. Others gave us the assurance that gas would be prohibited by the League of Nations, and would not be used again. Without competing with these prophetic inspirations, he would say that after observation of the manner in which the chemical industry had reacted to the difficult problems of the last war, he was convinced that whatever form the next war took the British chemical industry would be equal to whatever demands were made upon it.

Mr. R. G. Perry

Mr. R. G. Perry, President of the Association of British Chemical Manufacturers, in proposing the toast of "The Alkali Industry," in celebration of the formation of the industry a hundred years ago, said: The British alkali industry and its development over a hundred years—what a wealth of wonderment does such a sentence conjure up! To imagine England without alkali one must think of Widnes without soap, Northwich without salt, and Port Sunlight with very little sun. (Laughter.) I wonder if any other industry has had such far-reaching effects and has been so universally beneficial. Looking back over the experience of one's own life and reading the record of the lives of our predecessors in this industry, one striking fact emerges—the curiously close connection between this industry and the great social upheavals of the last century. The alkali industry was conceived in revolution, fathered by war, and nourished by strife. Towards the end of the French Revolution, when the French Government needed alkali, they offered a prize to the inventor who could provide a process for producing soda ash from salt. That prize was won by Le Blanc, and his process has been the established method of producing alkali in this country and other countries for nearly ninety years after its discovery.

Milestones in Chemical Progress

Then we come to the Napoleonic Wars, when the Government of this country raised its revenue in part by its famous, and perhaps pernicious, Salt Tax; the repeal of the Salt Tax provided the opportunity which the energy and acumen of Mr. James Muspratt, the grandfather of our present chairman, Sir Max Muspratt, seized, and in 1823 he established the first unit of an alkali plant in Great Britain. Mr. James Muspratt achieved a great success and conferred a lasting benefit on his country. The progress of the industry was steady for the next few years, and the first marked change was in the American Civil War, shortly after followed by the great Franco-Prussian War of 1870, when exceptional activity was seen in the alkali industry.

This was followed, as it usually is, by over-production, which spelt bad trade and the need for economy, and the need for economy meant investigation and the stimulating of research, and, sure enough, the answer quickly came. A few years after that came the now well-known Solvay process, applied by that outstanding genius, Dr. Ludwig Mond, and it is not too much to say that the discovery of that process and the opening of the great works of Brunner, Mond & Co. at Northwich have made Great Britain supreme among all the nations of the world in the production of alkali.

The natural result of this discovery was again investigation and research, though at this time it was more of a commercial and financial nature, and it was thought by the manufacturers of the Le Blanc process that it could be produced more cheaply and with a better profit by amalgamation, and then they saw the formation of what I can only describe as that great national asset, the United Alkali Company. (Applause.) May I be excused if I do not confine myself literally to the letter of my toast, because I think "the alkali industry" is becoming somewhat of a misnomer. Take the United Alkali Company, whose guests we are to-night; by their name we might suppose they were purely specialists in alkali. Nothing could be further from the truth; they are, in fact, the greatest manufacturers of sulphuric acid in Great Britain, and of other heavy chemicals as well, the importance of which is quite as great as that of alkali. I almost think it would be better to speak of it as "The British Heavy Chemical Industry," and, if it were, the public would more properly appreciate the work done year in and year out by the United Alkali Company.

The next development in the alkali industry was the discovery of the process of decomposing brine to caustic soda, and then we saw the formation of that well-known company the Castner-Kellner, who are now among the leaders of the industry in England. Following on the career of the industry I notice the marked effect that took place during the South African War; immediately before this war there had been bad times, abundant stocks, and few orders, but almost in a night—at any rate in a few months—the scene completely changed and caustic soda could not be bought for love or money.

The last milestone along this brief review is that of the great World War through which we have passed; it is far too great a subject for me to do more than merely touch upon; moreover, having heard the very kind remarks of General Thuillier,

it is not for me to say any more of the part that was played by the alkali makers in that war. To such an audience as this it is superfluous for me to attempt to mention minor improvements made in the processes during this long period, but I think it would be fitting to mention the sulphuric acid recovery process, because that prolonged the life of the Le Blanc process by some years. The Le Blanc process received sentence of death from Dr. Mond about 1880, but it has been a hardy, long-lived plant, and I am not quite sure that it could be truly said to be absolutely buried yet.

Looking Forward

It is a wonderful thing for a country to be able to say that for a hundred years it has been the cheapest and most efficient producer of a commodity in the world, but I can state that unhesitatingly. That is the case of Great Britain with alkali, for nowhere, even if nature has taken a hand in providing large deposits of natural soda, can England be said to be behind. If I may attempt to provide some explanation of the wonderful success of this industry in England I should say it is due to three main causes: first and foremost the almost unique scientific attainments of the men who formed the company in England; secondly, the fact that for once Great Britain is possessed of the raw material with which to found the industry; and, thirdly, the altogether exceptional freedom from labour troubles and unrest which this industry has enjoyed.

Quite a number of years ago I remember a well-known newspaper advertising—I suppose it wanted to advertise itself—that it would give a gold medal to any British workman who could prove that he had been in the uninterrupted employment of the same firm for fifty years; the result of that was that we applied for forty-seven medals in the company with which I am connected. The newspaper people were aghast, and in a letter of apology they said they had no idea that such longevity and contentment existed in the alkali industry, and would we be satisfied with three medals? (Laughter.)

A very prominent Labour leader once asked me how I could account for what he rightly admitted was the exceptional freedom from labour troubles which the alkali industry enjoyed. I replied I thought it was due to the very high proportion of trained and educated men that the industry employed. I hope it was true, because, if so, it may be an additional inducement to this and other industries to employ more chemists, because there is no greater essential for the country's success and safety, whether in peace or in war, than the maintenance of a great band of highly-trained chemists. Present conditions tend to separate the director from his workpeople too much; at the same time I must admit that the alkali industry has always recognised the value of the personal touch. The wages questions of to-day are so important, stated with so much pomp and ceremony, that it is difficult to believe they were differently dealt with in years gone by. When I was a very young man I was in the office of my chairman one day when a knock came at the door; there entered a heavy, ungainly youth, who said, "Please, sir, you said I might come and see you about a rise in wages." The chairman looked at him, and said with a smile, "Well, by the look of you, I should think you are worth a shilling a stone." To my surprise the youth said, "Thank you, sir; that will suit me very well. I am seventeen stone and I am only getting fourteen shillings a week." (Laughter.)

The Growth of Co-operation

I cannot conclude this review without referring to the splendid strides which the alkali industry has made in another phase altogether—I refer to the closer co-operation among the members of the industry. It has been the greatest pleasure to me to see the great success of the Association of British Chemical Manufacturers set up in 1916; there were reasons for the setting up of that body other than the war, and we now see the influence and power of the association increasing day by day; moreover, the better understanding of which that is an example is not confined to the manufacturers. I think our Government Departments did not know us very well before the war, and I am sure we did not quite fully understand their requirements. Perhaps it would be true to say that a conference of manufacturers in pre-war days would be looked on by the officials with a jaundiced eye; this is changed now, and the mutual outlook is one of genuine respect.

To adopt a simile from the national game, the alkali industry has stood up to all the bowling brought against it, and has scored a century and is still "not out." Whether the future bowling comes from Germany, America, or even Japan, the same straight bat and the same courageous eye will enable our descendants, when they meet a hundred years hence, as I feel sure they will, to say that the British alkali industry has scored 200 and is still "not out." (Applause.)

Sir Ernest Oldham, in supporting the toast, emphasised the importance of co-operation between all parties in industry and the greatly improved relations between industry and Government Departments.

Sir Max Muspratt

The Chairman, in response, first read the following messages:—

"On behalf of the Grand Council of the Federation of British Industries, I beg to tender hearty congratulations and good wishes to the United Alkali Company on the occasion of the centenary of the establishment of the alkali industry in Great Britain. I personally much regret I am unable to be present.—Eric Geddes, President."

"The Board of La Société Solvay and colleagues associate themselves with all their heart in your glorious centenary. Recalling and appreciating the long and cordial relations which have united the two societies, they express their most sincere and friendly wishes for the prosperity of the United Alkali Company and their directors."

"The Society of Chemical Industry sends congratulations on the centenary of the establishment of the alkali industry. It recalls with pride that its senior vice-president is your revered father, Dr. E. K. Muspratt.—E. F. Armstrong."

I should be less than human (the Chairman proceeded) if I did not feel a very proud man to-night. I am proud of the industry with which I have been associated since about the age of ten, because at the age of ten I declared to my family that I was not going to be a postman or the driver of a locomotive, which had been my earlier ambitions—I was going into the chemical trade. I do not think I ever knew of the name alkali at the time. I venture to say that that enables me to claim that from the age of ten I have been associated with the alkali industry. I need hardly say that I am very, very proud of my predecessors and my ancestors. I do not think to-night you would expect any words from me upon that subject. But I am also very proud of the company who have assembled here to-night to take part in what might be declared to be purely a trade celebration. I am also very, very proud of the opportunities that the chemical industry has had in the past, opportunities to which it has risen, and I am proud of the opportunities it has in the future of playing an even greater part in the history of the world than it has in the past.

Early Days of the Company

Let me go back for a moment to the present company. We have one of the most distinguished assemblies that has ever met in Liverpool. On the occasion of the centenary of the alkali industry I cannot help throwing my mind back, not 100 years, but say 95 years, and imagining whether it would be possible for the Mayor, as he then was in Liverpool, and my grandfather to sit side by side for two hours without serious disagreement. (Laughter.) If I had been there I could not have stood the strain, and I can assure you that my grandfather was far less capable of standing the strain of sitting next to the Mayor of Liverpool than I should have been. Unfortunately, at the last moment, the leader of the City Council of Liverpool has fallen out through causes over which he had no control. I suppose the leader of the Council 100 years ago had to take a fairly strong hand in turning my grandfather as an alkali manufacturer out of Liverpool. (Laughter.) The leader of the Council at the present time and I have had our words also. If Sir Archibald Salvidge had been present to-night I could have assured him that anything we have had between us was as nothing compared with what he would have suffered if my grandfather had still been alive. (Laughter.)

Now Lord Derby and Lord Stanley are not present to-night. Lord Stanley, who intended to be present, unlike Dr. Clayton, is not an intimate friend of a Labour leader—(laughter)—and when Lord Stanley, I suppose about Tuesday evening, went to the Chief Whip to ask to be allowed off to come to Liverpool, he was told that Dr. Clayton had collared all the

good " pairs " of the Labour Party, and Lord Stanley could not come. The Stanley family is so closely associated with Liverpool that again I venture to throw my mind back over the century and think of the time when the Rupert of debate lived at Knowsley Hall, and I can imagine that when the south-east wind blew his eloquence reached the very highest point that it ever attained, for the language was not such as he could have used in the House of Lords. (Laughter.)

We have, however, a very notable company here. The Civil Service has been referred to by Sir Ernest Oldham. The war has produced a mutual discovery of the Civil Service and the manufacturers of this country. We have had many and many a tussle, but we understand one another now as good Englishmen and good sportsmen, and the settlement of all the differences has led to a closer alliance and a closer understanding, which is all good for the future of this country. We have amongst us distinguished scientists who in many ways in the earlier part of the war were quite as bad as the Civil Service from the point of view of the manufacturers. There again we fought our battles out, we understand one another, we appreciate one another, and that is all leading up to the benefit of this great country. In all future emergencies, without all this preliminary sparring, we can work together for the common end, the good of the Empire. (Applause.) Lastly, the Prime Warden of the Dyers' Company, who has brought us into touch with the great mysteries of the past, is

"Empire Mail" Photograph

Visitors to the Marsh Works

present here to-night, and many leaders of commerce in Liverpool are here with us also.

What the Centenary Means

And why have we come together? We have not come simply to dine. Most of us have reached the age when the mere fact of a dinner does not draw us from our family hearth. But the dinner is the outward—and inward—and visible sign —(laughter)—of a coming together for a common object, and I venture to say that you have come here to-night because consciously or unconsciously you have a sense of the great interdependence of all the great industries of this country. And the chemical industry, so closely allied to every one of the other industries, is, to use a hackneyed word, a key industry in every sense of the word. We have come together also because the experience of the trials of the times through which we have passed has brought to every one of us the sense of the necessity of co-operation rather than unnecessary competition and bickering. We have come together with a desire for goodwill which, in spite of the superficial difficulties and differences that exist at the present time, is firmly impressed upon us as one of the necessities of the nation and the Empire.

Fortunately for us as hosts, the centenary of the alkali industry is a suitable landmark of peaceful development and at the same time national defence, which all of us feel and to which each one of us is prepared to pay tribute at the present time. The chemical industry has, in common with all the industries of the country, great problems and great difficulties to face, but we venture to think that we have special advantages in studying those problems, and therefore we have special responsibilities in contributing our quota to the solution of those problems. Those engaged in the chemical industry have to deal constantly with questions that are always new. So our mind is trained in dealing with new problems without prejudice and without bias. The necessities of our industry also mean that we have to study science in the broadest and the widest sense.

Industry's Dependence on Science

Without the scientific basis the chemical industry vanishes into ruins. And so we have often, against our will, been trained to clear thought, to accurate sense of proportion, to be ready for change, but only after the fullest test of criticism and discussion. Therefore we have all the elements of profound conservatism tempered with all the elements of advanced progress. Our ancestors have stood the test, and we connected with this industry must follow and be worthy of them. But we are living in days when material prosperity and material results are not enough. We have to deal with deeper and profounder problems. It is no good having material success in the chemical industry in a world that is falling into ruins because the social problems were not properly understood or dealt with. Our mission to the world—I am appealing to every man who has been trained in the chemical industry—is to deal with all the problems of the world, and to put our knowledge and our experience to the advantage and assistance of the world in dealing with those problems.

We must not only look at the century of material progress which we are celebrating to-night. We have to hark back even further, to the old visionary alchemists. I would be sorry for the most distinguished alchemist who had to pass an examination set by Sir William Pope upon " What is a synthetic organic chemical ? " but we have to remember that they also were our predecessors. We have to try and catch some of their mysticism, some of their belief that everything could be cured by the study of alchemy. We have got to have their vision, their spiritual vision, and their imagination. We have got to put this into the service of the world while it is in the melting pot. We have to deal with the social problems, the labour problems, the moral problems of the next century, and in celebrating the end of the first century I look to an even greater and more magnificent future in the century that lies before us. (Loud applause.)

Mr. Roscoe Brunner

Mr. ROSCOE BRUNNER, who also responded, claimed to have been associated with the alkali industry from the early age of four, when he went with his father to Winnington, and decided that he was " It " in the alkali industry. (Laughter.) General Thuillier had spoken of the aid which the industry gave in the war. Britishers were always unduly modest, but he assured him that the whole chemical industry was very proud of the part that it took in the war, and that whether in war or in peace, the whole chemical industry would bear its part in the future.

The history the company had published referred to the difficulties that their predecessors experienced. The romantic history of the industry seemed to be full of difficulties. Quite late in the career of their predecessors there were two difficulties whose names were Mond and Brunner. (Laughter.) But in spite of all this, their predecessors and their company had surmounted all difficulties, and in these days they were, as Mr. Perry had said, the largest producers of sulphuric acid and very large producers of very many chemicals which were necessary to the life of the country. Mr. Perry referred to the family history which had had the result of producing cordial relations between management and labour. It was always a difficulty when a concern grew so big that it could not know the whole of its men ; but in this trade, perhaps more than in any other, the family interest had been kept up. He ventured to say it was that interest, maintained from family to family, which accounted for the good relations existing between their employees and themselves. At no time in the history of the industry had more brains been put into it than at the present time. They looked forward, as the chairman had said, in the coming century to going ahead as they had done in the past, and to a greater degree of success not only for themselves but for the nation and the Empire at large. " I hope," he concluded, "one hundred years hence that my great-great-grandson will be in support of your chairman's great-great-grandson at the 200th anniversary of the foundation of the industry." (Applause.)

The Lord Mayor's Tribute

Mr. A. T. SMITH proposed the toast of "The Merseyside Municipalities."

In responding, the LORD MAYOR acknowledged the debt which the city owed to the leaders of the industry, and said there were no names which stood out so conspicuously as those of the founder's family. James Muspratt's works in Vauxhall Road were an earnest of the future prosperity of the city, and the names of his sons were associated with the city's history. To Mr. Sheridan Muspratt the city owed its first evening school, and to Dr. E. K. Muspratt, one of their greatest citizens, the city owed the magnificent laboratories bearing his name—(applause)—which had rendered possible the great chemical school in the University. It was a matter of gratitude that Dr. Muspratt was still with them to share in that notable centenary; and he suggested that a message should be sent from that great gathering conveying to him their hearty good wishes and remembrances. His son (the chairman) had lived up to the traditions of his family. He was an active and important member of the Council, he had been Lord Mayor, and he had also represented one of the divisions in Parliament. Although in public life he was looked upon as a hard-hitter and bonny fighter, he had earned the goodwill of all classes of the community. It was with sincere good feeling that he congratulated him and the concern he controlled on its increasing prosperity after one hundred years. (Applause.)

Visits to the Widnes Works

Liverpool, April 19, 1923.

FOLLOWING the centenary dinner, a party of several hundred guests left here this morning by special train to inspect the company's works at Widnes. The party, in charge of conductors, were taken in groups over the Marsh Works. The total works of the company in Great Britain cover an area of 1,000 acres. The Marsh Works at Widnes are about 25 acres in extent, and immense industrial activity is crowded into the space. Here the visitors had an opportunity of seeing the various methods of manufacturing sulphuric acid. Plants are installed for the production of sulphur dioxide from pyrites, brimstone, and spent oxide, and in addition oleum of various strengths is manufactured by the contact process. Without going into the details of so large an organisation, what impressed one at once was the excellent condition and lay-out of the plant, the large scale and the smoothness of the operations in progress, the ample ventilation and space, the good order and cleanliness in conditions where the contrary might easily be present, the arrangements for labour-saving and mechanical handling, and the co-ordination of the various operations.

The power station on the west bank of the river attracted much interest. This was started in November, 1920, and has an ample supply of condensing water from the River Mersey,

"Empire Mail" Photograph

Visitors to the Pilkington-Sullivan Works

The MAYOR OF WIDNES having also responded, the following telegram was sent to Dr. E. K. Muspratt, Seaforth Hall, Liverpool.—"Guests assembled at centenary dinner of alkali industry send congratulations, remembrances and good wishes. They pray that your path may be as the path of the just shining yet more and more unto the perfect day.—WILSON, Lord Mayor."

"The Chairman"

Mr. W. A. TENNANT, introduced as "another descendant of one of the giants of the industry," proposed the toast of "The Chairman," remarking that Sir Max was a splendid chip of a grand old block. In these days, when the importance of heredity was more thoroughly recognised than it used to be, they could point to the Muspratt family as a remarkable example of intelligence, ability and character. He was proud to think that the friendship and association which had existed between the Muspratt and the Tennant families almost since the birth of the alkali industry still remained unbroken. It was not because Sir Max was a grandson of Mr. James Muspratt that he occupied his present position. Chemicals did not absorb all his energies. As Lord Mayor of Liverpool he had done a great work for the citizens, and he still wielded a great power in the councils of one of the political parties in Lancashire. During the war he stuck manfully to his job, giving all his energies to increasing the output of those chemicals that were so urgently needed by the war department. The baronetcy conferred upon him by the King was certainly the most popular in the last honours list. (Hear, hear and applause.)

The Chairman briefly acknowledged the toast, and the proceedings closed.

in addition to being conveniently placed for fuel supplies and disposal of ashes. The turbine room contains two turbo-alternators, each of 8,000 h.p. at 3,000 revolutions per minute, generating alternating current at 6,600 volts. The condensing water flows from the river to screen chambers, from which it is delivered to the condensers by two pumps, each with a capacity of 33,000 gallons per hour. The boiler house is equipped with eight water tube boilers and mechanical stokers, each boiler evaporating 25,000 lbs. of water per hour to steam at 225 lbs. per square inch. The coal is delivered by rail, and discharged from the wagons by means of an automatic tipper; it is then elevated and distributed to bunkers over the boilers. The ash-handling equipment consists of suction plant and receivers, into which the ashes are drawn, and quenched with water, before being discharged into railway wagons. The 6,600 volt switchgear is of the remote electric control type.

Efficiency through Co-operation

Returning to Liverpool the party were entertained to luncheon at the Adelphi Hotel by the chairman and directors of the company. Sir MAX MUSPRATT, who presided, said that at the beginning of a new century they looked forward to further expansion and desired the fullest co-operation in the work of advancing the interests of the industry, the country, and the Empire. It was desirable that those who did business with the company should realise some of their problems and difficulties. The company had to the best of their ability and resources approached, and he hoped attained, the highest degree of technical efficiency which was possible in the chemical industry. Their works had been thrown

open, because they had no secrets, although they had difficulties, and at present they regarded themselves as the best equipped and most efficient chemical company in the world.

The toast of "Success to the Company" was proposed by Mr. Cowburn (Manchester) and supported by Mons. Couvreur (Paris) and others.

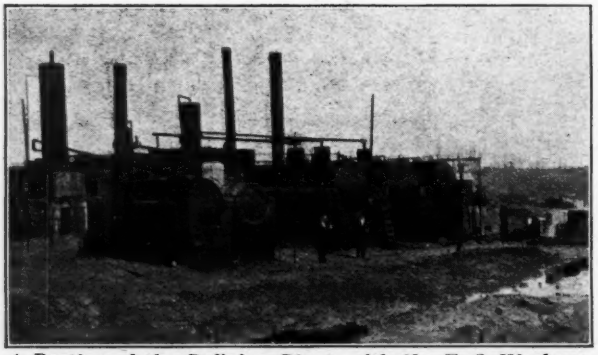
Queen Mary's Impressions of Widnes

Dr. G. C. CLAYTON, M.P., responding as one of the directors of the company, mentioned that one of their guests had been a customer for 47 years, and as his late father had also been a customer their association with the company extended to 87 years. That was a very pleasant circumstance and indicated that their goods were fairly up to sample. He regarded Widnes, for which he was the proud member, as the most important chemical town in the world. Some people thought its atmosphere might be improved, but he did not believe it. (Laughter.) In some conversation with Queen Mary he happened once to mention Widnes, and she replied "Widnes! Didn't I drive through it once on the way to Knowsley?" "Yes," he replied, and the Queen continued, "A most interesting town, and I believe you make chemicals there." "Yes," he replied; "Your Majesty may possibly have noticed it." (Laughter.)

British Company's Oil Fields in Texas

View of a part of the Somerset Oil Field, Texas, U.S.A.

OIL is admittedly the key to nearly every form of transportation on land, in the air, on the sea, and under the sea. It is probably the most profitable of nature's resources, in view of the small cost of operation after the initial expenditure on production. The demand for oil is unlimited because industrial progress in a score of directions absolutely depends upon a steadily increasing flow of it. In five years consumption increased 300 per cent.; production only 40 per cent. (in Canada and the United States). If production stopped, there



A Portion of the Refining Plant, with Mr. F. C. Workman (chairman) and Mr. M. L. Roark (secretary)

would only be sufficient oil in storage to carry on industrial operations 100 days. Of the world's supply of crude oil 66 per cent., or two-thirds, is produced in the United States alone, while of this the State of Texas itself produces 25 per cent. All over the world, and in every portion of the Empire, British capital and science are to-day in the van in the hunt for oil. British interests are definitely in the oil industry, and are in it to stay.

An example may be taken from the substantial progress made by the All British Oil Company, Ltd., 9, Victoria Street, S.W.1, during the past few months. Although only converted from a syndicate into a public company in July last, the development has advanced so rapidly that the directors have already found it necessary to acquire refinery interests, and control of loading racks and shipping facilities, in order to complete arrangements for importing their products, and marketing them in the British Isles. Their producing wells and refinery are located in the Somerset Field, Texas, which is the best known shallow oil field in the world. With the close of 1922, this shallow oil pool completed its thirteenth year without a single dry hole in proven territory since the discovery of the field. Last year 177 wells were drilled, and each one was a producer. The output is not large, but the wells are long lived. This is a very important item, and the field now produces about 4,000 barrels of oil per day, with only approximately 25 per cent. of its proven acreage drilled up. The oil is described as of high grade, ranging from 32/42 Beaumé, which gives a good petrol content. This oil is now being much sought after by large companies, owing to the threatened shortage of the lighter grades of this quality, which are only found in oil fields similar to the Somerset. As the company has complete control from the time the crude oil leaves the wells until the refined product reaches the consumer, it is well placed to furnish the best grades of unvarying quality.

In the Somerset Oil Field (shown in the large photograph) there are 700 producing wells, with about 60 drilling outfits constantly at work. Geologists and oil men estimate that there is room for 4,000 wells in the proven area. The largest production is found at from 1,400 to 1,700 feet. The field has been producing for about 13 years and has the distinction of being an oil field without a dry hole. Refineries, pipe lines, railroad, and marketing facilities are all on the spot.

The Title "Chemist"

To the Editor of THE CHEMICAL AGE.

SIR,—A discussion on the title of "Chemist" can at the present time have no practical result; it is obviously logical that persons engaged in the science and practice of chemistry should be termed "chemists"; in fact, there is no other word in the English language which is effective for describing them. It must be remembered that chemistry, as it exists to-day, is a young science, and a century ago there were no chemists; and it was the pharmacist of that day who came most nearly to the practice of chemistry.

Pharmacy has developed contemporaneously with chemistry, but along gradually diverging lines; and, though it is not entirely divorced from chemistry this science now enters to but a minor degree, and the description "chemist" as applied to a pharmacist has ceased to be a true one to the logical mind. Nevertheless, it still remains, and cannot at the present time be displaced; the Pharmacy Acts have conferred a legal right to the pharmacist to be a chemist; public opinion holds that he is a chemist, and within the last few years a powerful vested interest has arisen.

It is true that the law can be changed, but the difficulties of making such a change in face of public opinion and vested interests are insuperable. In addition, few if any chemists have a real grievance; what class of "chemists" desire the change? The academic chemists show no signs; the analysts and consultants are not up in arms; the technical chemists are not clamouring, and it seems that it is really people whose knowledge and skill are so small that their recognition as chemists is problematical, who are most desirous of getting the—or a—title.

Our friends the pharmacists, who have the legal right to be chemists, have never made the least effort to prevent any *bona-fide* student or practitioner of chemistry from calling himself a chemist, so long as he refrained from keeping open shop, and from their side the subject has been regarded with a reasonable spirit of compromise. While the leaders in pharmacy recognise, as do the leaders in chemistry, that the change is bound to come eventually, and the chemist will some day be called a "chemist" and the pharmacist a "pharmacist," they know the time is not yet ripe. Let us, therefore, continue the compromise, and devote our attention to the education of public opinion.—Yours, etc.,

H. DROOP RICHMOND.

Analytical Laboratory, Nottingham.
April 21.

Laboratory Porcelain Crucibles

To the Editor of THE CHEMICAL AGE.

SIR,—Some time ago you printed a letter of mine drawing attention to the diversity of prices quoted for chemicals in London and in Birmingham. To-day I ask your space to inquire where I can obtain ordinary laboratory porcelain (or other) crucibles which will stand reasonable treatment for a length of time comparable with the endurance of the Japanese crucible. I do not care of what materials the ware is made, but I would prefer British goods. If any of your readers can help me I shall be glad if they will write to this address.—Yours, etc.,

REGINALD G. JOHNSTON,
Scientist in Charge.

Midland Laboratory Guild, Ltd.,
King Alfred's Place,
Broad Street, Birmingham.

Large Bentonite Deposit

PROFESSOR PITCHER, Professor of Mining at the University of Alberta, Edmonton, states that one of the purest deposits of bentonite in the world has been found at Rosedale, Alberta, on the Canadian National Railway near Drumheller. There are millions of tons of it in Alberta, he said, and its proper development would mean a fortune for the company taking the work in hand. Bentonite is a hard, rock-like substance of a colloidal nature, which swells greatly when exposed to water. It is used in soapmaking, and for many other industrial purposes, such as making electrical insulating material.

Nitrates from the Air

The Synthetic Ammonia Process

THE final lecture of the series known as the Cantor lectures, was delivered by Mr. E. Kilburn Scott at the Royal Society of Arts, London, on Monday.

Reviewing the consideration of the subject of "Nitrates from the Air," Mr. Scott first referred to the Häusser bomb process, mentioned in the previous lecture, and pointed out that Mr. H. A. Humphrey, of Billingham-on-Tees, had improved this by the invention of the Humphrey pump which used part of the energy of the explosion in a satisfactory way. Although the concentration of nitric oxide obtained was at best only 1 per cent., by absorbing it under a pressure of three atmospheres the process was simplified and rendered less expensive.

He then passed on to a consideration of the synthetic ammonia process, the credit of which mostly went to Dr. Haber, of Karlsruhe, although Le Rossignol and Maxted had a considerable part in it. After explaining that ammonia could be synthesised from nitrogen and hydrogen, he said that the necessary nitrogen was obtained from liquid by means of a Linde plant. Oxygen was a by-product, which at present had to be wasted, owing to certain patent restrictions. Where electric power was cheap the hydrogen was best produced by the electrolysis of water, and cells had been designed in the U.S.A. to take 10,000 amps. The method was in use to-day by Lever Brothers for hydrogenation of oil for margarine manufacture. Otherwise the hydrogen could be obtained from water gas by freezing out the carbon monoxide in a simple plant, which was shown later on a slide. The combining of the two gases was carried out with the aid of a catalyst, which was originally iron. The ammonia obtained could be converted to sulphate or chloride for fertilisers, or it might be oxidised to nitric acid, in the presence of a platinum catalyst. This process was investigated in England during the war, but has not yet been adopted here, though it has been in use in Germany a long while. A considerable improvement on the Haber ammonia process was made by M. Georges Claude by increasing the working pressure from 200 to nearly 1,000 atmospheres, obtaining an increase in the yield of ammonia of nearly five times. Latterly chrome-steel was being used as a catalyst. Slides were shown of this plant and also of the English experimental oxidation plant. Others showed the difficulties of working at the very high pressures needed for the Claude process, although the plant was small.

Finally, the lecturer emphasised the need for research on the nitrogen problem in this country. In Germany, with the backing of the Government, the Haber-Bosch process operated by the B.A.S.F. produced initially 10,000 tons of combined nitrogen per annum, while in 1916, with the backing of Rathenau, 210,000 tons were produced. Brunner-Mond using the same process hoped to produce 10 tons per day this year at Billingham-on-Tees.

Discussion

Sir CHARLES BAKER took the chair and, in opening the discussion, paid a general tribute to the lecturer's presentation of the subject.

Dr. J. A. HARKER pointed out that the original inventor of the Häusser process had tried to use the explosion pressure without success, but the Humphrey pump had solved the problem. With regard to cyanamide, there was the drawback that coal would relatively never be so cheap again as before the war, and also cyanamide as a fertiliser sometimes went to cyanide and poisoned the crop. He considered this process was more suitable for making mixed fertilisers, such as phosphazote or for other carbide products, than for making nitrates. With regard to the synthetic ammonia process, he could say that "any old" electrolytic hydrogen cell would not do, and the American one, which was intended to take 10,000 ampères, had not been a success, and that the American engineers were now coming over here for cells. He thought Mr. Scott had perhaps misled the audience with regard to the enriched arc process in which the nitric oxide was liquefied out. It had been by no means an unmitigated joy, and all three plants using the plan had met with disaster. The arc process had not shown itself capable of improvement in detail. The situation in this country was not as bad as had been painted; he (Dr. Harker) did not believe in copying other

nations, but in developing on our own lines. The Billingham plant was not a parochial affair. It was designed for an ultimate production of 300 tons daily, a greater output than the Odda works. The work of the Nitrogen Products Committee was not being wasted.

Sir CHARLES PARSONS compared the high pressures used in the Claude process (over 7 tons per sq. in.) with that developed in a heavy gun (about 20 tons per sq. in.), but the chemical process had the disadvantage that it was carried out at red heat.

Mr. C. J. GOODWIN, after emphasising the need to produce nitrates from the air, said he was particularly interested in the Häusser process, which was peculiarly suitable where there were good supplies of coal. Requiring oxygen it would work well in combination with the synthetic ammonia process, the latter being used to produce ammonia, the former nitrates, without using the wasteful oxidation method. By removing hydrogen from the coke-oven gas before leading it to the Häusser bomb or Humphrey pump it would be possible to use the hyrdogen for the ammonia process, and also it would be possible, he said, to make power alcohol at the same time. He suggested finally that the Royal Society of Arts might perhaps be able to do something to encourage and co-ordinate research on the problem in this country.

Benzol from Blast Furnace Gases

Some Practical Methods of Recovery

IN a paper on "Comparative Methods of Debenzolising Wash Oil and the Recovery of Wash Oil from Blast Furnace Gas," given before the Northern section of the Coke Oven Managers' Association at Durham on Saturday, April 21, Mr. F. D. Whittaker, of Bannockburn, Stirlingshire, said that though the conditions generally in a blast furnace were very different from those in a coke oven, yet the reactions in the upper and cooler regions were similar and, in the case of a furnace using raw coal, resulted in the distillation of the coal and, consequently, the presence in the gases of ammonia and tarry vapours in sufficient quantities to admit of their profitable extraction. An important feature was the enormous volume of gas to be treated in relation to the comparatively small amounts of by-products to be recovered—this being chiefly due to the atmospheric nitrogen introduced with the blast. The volume of gas per ton of coal was about 140,000 to 150,000 c. ft. at atmospheric temperature, but at the temperature prevailing at the throat of the furnace (400 to 600° F.) that volume was almost doubled. The principles of recovery were practically those adopted at coke ovens, condensing and scrubbing, only on a much larger scale. The order of the recovery parts varied somewhat in different plants, but, in general, the arrangement was, green gas main, tar washers, condensers, exhausters, liquor washers and return gas main.

The washing medium in the tar washer was tar. The washer was of special construction and as a result of the high temperature of the gas, partial dehydration of the tar was effected in it and the tar overflowing was taken direct to the stills. Condensings from all other seals and drains were run into a common stock pond whence the liquor was decanted from the tar. The atmospheric condensers were about 50 ft. high, and in one case consisted of 12 chests in pairs of 18 tubes 20 in. diameter. The temperature of the gas was then reduced to about 65° F. The gas was washed on the counter current principle and the liquor dealt with in the sulphate plant. Tar emulsion, as it was technically termed, containing about 40 per cent. liquor, was pumped to the stills and the liquor and oil distilled off in one fraction, leaving a residue of pitch. The liquor and oil were separated in the usual way. After the recovery of tar acids, the creosote or fuel oil was suitable for benzol washing.

With regard to the debenzolising of wash oils, Mr. Whittaker first gave a brief survey of the more important factors governing the successful recovery of benzol from coal gas. He then described the modern type of still, together with the usual adjuncts of heat exchanger, superheater, condenser and separator for benzol and water; also the debenzolised oil cooler as commonly installed in North of England coke oven plants, where coal tar creosote was in common use as benzol wash oil. He showed the benzol plant in use in some Scottish works, blast furnace oil being the chief benzol solvent. In the case of the coke oven plant benzolised oil entered the heat exchanger at a temperature of 25° C. where, by absorbing the sensible heat of the outgoing vapours from the still the temperature was raised to 75° C. and thus it entered the superheater, where it was subjected to the heat of indirect steam at 150 lb. pressure after which the oil entered the still at 120° C. Open steam entered the bottom section of the still at 15 lb. pressure and passed through the descending oil. By that means the oil was completely denuded of its benzol and flowed to the coolers with all the sensible heat equivalent to its temperature of 114° C. The benzol and all the water vapour, together with the benzol vapours from the superheater, passed from the still to the heat exchanger and so to the condenser and separator, the benzol leaving the separator for storage at a temperature of 25° C. In the case of the Scottish works the process might be described as the low temperature method, the course of the benzolised oil (locally termed charged creosote) and benzol vapours was the same as that of the high temperature process; but there was the marked difference that water from the steam or other source passed both ways, some with the benzol vapour, the balance with the debenzolised creosote. The still in general use was similar to an ammonia still, being a vertical column divided horizontally into a number of chambers, fitted with the usual hoods and overflows, the depth of seal being about two to three inches. A heat exchanger was always part of the plant and in some cases a superheater was also introduced. Benzolised oil entered the heat exchanger at a temperature of 17° C., where in its counter current passage to the benzol vapour and steam its temperature was raised to 30° F. prior to entering the still. In that arrangement, the fresh saturated creosote entered at the top of the column and encountered the steam already containing large volumes of benzol vapour. In passing from section to section, being continuously subjected to the action of steam containing less and less benzol, it was gradually denuded, until it left the apparatus entirely freed from its volatile benzol compounds. The benzol and water vapours, escaping from the top of the still at a temperature of 75° C., were largely condensed in the heat exchanger, from which condensate and remaining vapours flowed to the cooler and separator. The debenzolised oil containing water left the still at a temperature of 85° C. and entered a separator. The oil then overflowed from the top of this into the cooler, and then to the debenzolised or stripped creosote oil tank.

It would appear, from the consideration of the methods described, that the recovery of benzol from wash oil was quite a flexible operation. Though carried out under different conditions of temperature, the result was equally effective in each. He pointed out that the high temperature method rapidly resulted in deterioration of the wash oil, which was as well as producing deposits on the pipes also encouraging incrustations from the cooling waters. On the other hand, impurities in the wash oil, either inherent or engendered, were largely dissolved or otherwise removed by the water of condensation.

The Physical Properties of Powders

AT a meeting of the Faraday Society, held at Burlington House, London, on Monday a number of papers were presented on the "Properties of Powders." Messrs. J. H. Shaxby and J. C. Evans, of University College, Cardiff, dealt with the "Variation of Pressure with depth in Columns of Powders." Measurement of the (average) vertical pressure p_a at various depths x in columns of lead shot and of powder indicated an exponential increase of p with x. The absolute value of the pressure appeared to be dependent on the state of packing of the column, and the resulting shape of the equal-pressure surfaces; if so, the observations supplied grounds for inferring that a difference in packing set in from the start, it being possible, after taking the first pressure reading, to predict fairly correctly the value of the maximum pressure. The general form of the pressure-depth curves agreed well with the equation $p_a = p_m(1 - Ce^{-kx})$ in which p_m was the maximum pressure and C and k are constants.

Dr. E. E. Walker dealt with the "Compressibility of Powders," and described the methods which had been devised for measuring the resistance of powders to compression by (*a*) static loads, and (*b*) blows from a falling weight. The resistance offered by powders made from various organic and

norganic substances to both these forms of compression had been investigated. A theory was put forward to explain the different forms of load-volume curves. Dr. Walker also gave a paper on the "Distribution of Densities in Columns of Compressed Powder." Local densities in columns of compressed powder were measured. The form of the density gradient curve was determined, and from this curve the distribution of pressure in a column of compressed powder was deduced.

Papers were also given on the "Temperature of Maximum Density of Aqueous Solutions," by Mr. Alan Taffel; the "Rate of Hydrogenation of Cinnamic and Phenyl Propiolic Acids," by Dr. E. K. Rideal, and on the "Coagulation of Milk by Acid," by Mr. L. Anderson, B.Sc. (communicated by Professor W. C. M. Lewis).

Chemists' Joint Dinner at Newcastle

The Value of Chemical Clubs

UNDER the joint auspices of the North Eastern Section of the Institute of Chemistry, the Newcastle Section of the Society of Chemical Industry and the Newcastle Chemical Industry Club, a "Chemical" Dinner was held in Newcastle on Friday, April 20, with Dr. H. Peile in the chair.

The Chemical Profession

The Chairman, in proposing the toast of "The Chemical Profession," said it was chiefly the great work that chemists achieved during the war which had led to a fuller recognition of their importance by the Government which had set up various research committees, all doing most useful work. Manufacturers generally were also beginning to realise the importance of the chemical profession. Up to the present we had been much behind in that respect and a change was taking place. That change was necessary if we were to hold our own. An increasing number of manufacturers and industrialists were organising research departments which were doing very useful work. In his own trade, the coal trade, they were still a long way behind as regards chemical knowledge.

Mr. CHASTON CHAPMAN, in responding, said that during his chemical career few things were more remarkable than the way in which the profession of chemistry had grown in recognition. Order had been evolved out of chaos, and a profession built up which claimed to stand upon terms of equality with medicine and the law (applause.) Those who were very enthusiastic were apt to complain and grumble that the profession had not received the full degree of public recognition to which they felt it was entitled. They ought not to be too impatient or expect too much at once. The English race was severely practical and did not, perhaps, appreciate so fully the importance of science as other nations did. It was up to the chemists to educate the lay public as to the great importance of chemistry. If they did not take an active part in the work of enlightening the public then no one else would. He outlined a scheme which he thought should be carried out by the Institute, or some other society; or, better still, jointly, whereby a series of lectures should be given to the public demonstrating the great importance of the chemists' work in all walks of life, particularly dealing with local industries and illustrated by experiments as far as possible. He looked forward to the day when the profession would be so organised that a member would be known to have the hall-mark of good training and professional conduct which would enhance the dignity of the profession.

Professor A. N. HAWORTH (Armstrong College), who also responded, said he hoped that the time would soon come when they would elicit from the public something more than the recognition obtained so far. It was not so many years ago that the greater part of the general public associated chemistry with gaily coloured bottles in a shop window. The war had assisted in dispelling that view. Already the profession was approaching the time when it might reasonably ask the public to receive it entirely on the same basis and acknowledgment by the State as the professions of medicine and law, and that every chemist practising as such should be on a Register. That might come, and perhaps in a few years. Dealing with the training of chemists, he said he was not at one with those who said that in training for a career in industrial chemistry one should include a close knowledge of one or more branches of industrial chemistry. He had had many assurances to the contrary from men who were chemical manufacturers. They often held the view that if a definite problem were to be solved it was better to have a man with a clear grasp of chemical theory and principles. Often the man trained in industry carried, quite unconsciously, the prejudices which that industry happened to carry with it. He would rather see a man turned out from the Universities with a firm grasp of the principles of the science of chemistry in all its ramifications. He would rather give that man to the manufacturer and let him try his hand at the problems than waste his time learning in a year in a University chemical laboratory what he could learn in three months in a factory. He considered that the revised course at Armstrong College was a step in the right direction, and he approved of the establishment of the Chemical Engineering Course in London on lines which insisted that the chemical engineer must be a chemist.

Dr. BEDSON, who received a most hearty welcome, proposed the toast "The City of Newcastle." In Liverpool the other day he said they been celebrating the establishment of the British alkali industry. He thought that something should be said about the Tyneside alkali industry being laid down seventeen years before it was started in Liverpool. (Applause.) Tyneside should assert itself and lay claim to its share of the glories of the British alkali industry.

The LORD MAYOR (Alderman W. Bramble) responded.

Chemical Clubs

Mr. R. B. PILCHER, in proposing the toast of "The Chemical Industry Clubs," said he was quite certain that such clubs helped chemistry. If they got out of the laboratory and met each other often in club life they would be not only better chemists but better men. (Applause.)

Dr. E. F. ARMSTRONG, responding to the toast as a member of the London Club, remarked that though they might be engaged as chemists they got on as men, and that was a fact they must not lose sight of. One of the striking things about the great scientists given to the world by Newcastle was that not only were they great scientists but they were essentially great men too. He considered that their clubs were a great educational force, and provided one of the most useful institutions in the chemist's life. (Applause.)

Mechanism of Diazo Coupling Reactions

AT a meeting of the Manchester Section of the Society of Dyers and Colourists (Dr. E. Knecht presiding), Mr. T. K. WALKER read a paper on "The Mechanism of Diazo Coupling Reactions." He said that although the diazo compounds, which had been known for more than sixty years, constituted one of the most reactive classes of bodies with which the organic chemist deals, and had proved of the greatest importance for synthetic and technical purposes, the actual "modus operandi" of some of their most important condensations was not yet fully understood. This was due largely to the fact that those substances present a complicated case of tautomerism, and also to the fact that the ease with which tautomerism occurred rendered it very difficult to decide which particular form of the diazo compound had taken part in a given reaction.

Within the last sixteen years several attempts had been made to ascertain by experimental work the mode in which diazo compounds coupled. Dimroth and co-workers (1907 *et seq.*) studied the reactions between diazonium salts and enols, and in some cases were able to isolate intermediate O-azo compounds which had the properties of diazo-ethers. Some of these bodies readily passed over to C-azo compounds and in certain cases the latter were liable to undergo further intramolecular change into phenylhydrazones. Karrer had shown that the coupling reaction with amines could follow a course similar to the process disclosed by Dimroth in the case of enols, intermediate addition compounds, in which the amino nitrogen atom functions pentavalent, being first formed, and subsequently undergoing intramolecular change. On the other hand K. B. Meyer, who had recently contributed materially to our knowledge of this subject, believed that coupling consisted essentially in addition of the diazo compound to an activated double bond in the molecule of the second component. Evidence had been found in support of all these views, but it did not seem likely that the question would be altogether understood until we had gained further knowledge of the valency distribution of the nitrogen atom in organic compounds.

From Week to Week

IN THE MATTER OF Chemicals and By-Products, Ltd. (in liquidation), Mr. H. G. Howitt, liquidator, announces that the business of the Company has been sold to Mr. W. F. Cooper, of the Cooper Laboratory, Watford, as from February 24, 1923.

IT HAS BEEN ANNOUNCED to the American Chemical Society by Dr. Müller, of Pennsylvania, that the rare element germanium has been found to possess medicinal properties and is likely to prove of great value in the treatment of certain forms of anæmia.

A REDUCTION in railway rates of 15 per cent. is announced for the carriage of minerals and iron goods, to take effect from May 1. A similar reduction will operate for general merchandise, while for general parcels there will be a reduction of 30 per cent. on present rates.

FOLLOWING ON THE DEATH of Mr. E. Brown, a member of the firm of Brown and Son, scientific apparatus makers, etc., of Wedmore Street, Holloway, London, the business of laboratory equipment engineers is being carried on as hitherto under the direction of Mr. F. Easterbrook, who acted as works manager for a number of years.

THE BUSINESS of E. F. Allden & Co., which for over 30 years has been carried on from 3, Love Lane, Eastcheap, E.C., has now been transferred to their former manager, Mr. J. Flack, who will continue the business on the same lines and under the old name, but at new offices at 19, Beer Lane, Great Tower Street, London, E.C.3.

AN EXPLOSION occurred recently at the dye-works of the National Anilene and Chemical Co., at Buffalo, U.S.A., in which two men were killed. It took place in the grinding department and the cause is at present unknown, but is being investigated. It is stated that no picric acid was being dealt with, and the possibility of a dust explosion is considered unlikely.

LIEUT.-COLONEL G. R. LANE-FOX, M.P., the Secretary for Mines, has appointed the following to be additional members of the Safety in Mines Research Board: Professor W. S. Boulton, Professor S. M. Dixon, Dr. J. S. Haldane, Professor C. H. Lees, Professor Jocelyn F. Thorpe. He has further appointed Sir Edward Troup to be a member and chairman of the board in place of Mr. E. J. Foley, C.B. Mr. A. D. Stedman has been appointed secretary to the board in place of Mr. E. Pudge.

AT A MEETING of the Senate of Queen's University, Belfast, on Wednesday, April 18, it was announced that the building committee having examined the possible sites for the new building for the department of chemistry had unanimously agreed that the ground at the west end of the Vice-Chancellor's garden in Elmwood Avenue was the most suitable. The committee has handed Dr. Stewart's plans to Mr. Close, the consulting architect of the University, and instructed him to prepare sketch plans and obtain an estimate of the cost.

A VERDICT of "Accidental Death" was returned at the inquest on Mr. G. S. Linnington, an employee of Erith Oil Works, Ltd., who was killed by the explosion of an oxygen compressing plant. In the course of the evidence it was stated that the probable cause of the explosion arose in the lubrication of the plant. The machine was in good order and the oxygen of its normal purity, but the lubrication presented difficulties, the compressor in question being lubricated with a soap solution, which might have contained some combustible material, derived from heating of hydrolised fat in the soap.

THE GENERAL MEETING of the Chemical Engineering Group has been fixed for Friday, May 4, at 6.30 p.m., in the Engineers' Club, 39, Coventry Street, W.1. The annual meeting, at which the ordinary formal business will be transacted (including the Secretary's report of the work of the Committee for 1922 and the presentation of balance-sheet and accounts) will be followed at 7.30 p.m. by an informal dinner in the Club (morning dress), and later by a social evening interspersed with musical items. The Chairman of the Group (Mr. J. Arthur Reavell, M.I.M.E., M.I.Chem.E.) will preside. Members of the Group are permitted to introduce non-members to the dinner and the subsequent proceedings.

THE Joint Industrial Council for the chemical industry met on Thursday, April 19, to discuss the question of the proposed reduction in wages of a halfpenny an hour for shift workers. At the conclusion of the meeting it was stated by Mr. Kelly (Workers' Union) that as an outcome of the discussion a modified proposal had been put forward by the employers and on this the unions would consult their executives and members and notify the result in a few weeks. It is understood that the employers now propose to reduce the shift rate by ½d. per hour from May 10, and a further ½d. from July 1. The employers have stated that they will be satisfied with this, and if an agreement can be reached they will stabilise wages until the end of September. A ballot will probably be taken.

THE GOVERNMENT DEPARTMENT OF MINES have signified their approval of the latest improvement in liquid air mine rescue apparatus, originally known as the Blackett Aerophor, designed by Colonel W. C. Blackett, of Sacriston. The later improvements in the apparatus are the joint work of Mr. G. L. Brown, manager of the North Midlands Mine Rescue Stations, and Mr. F. P. Mills, F.S.I., M.I.M.E., chief officer of the Durham and Northumberland Collieries Fire and Rescue Brigade. The new apparatus gives a rate of oxygen feed to the wearer of not less than 3½ litres per minute, which is ample to enable heavy work to be performed with very rapid breathing, without causing discomfort. In the new design of apparatus a charge of 5½ lb. of liquid air is sufficient to allow air for two hours, and liquid air of oxygen purity as low as 50 per cent. can be used.

AT LEEDS, on Monday, April 16, before a meeting of the Yorkshire Section of the Society of Chemical Industry, Mr. J. A. Reddie, chief chemist at the Bradford Corporation's sewage disposal works at Esholt, contributed some observations on the production of alkali by bacteria. Dr. L. L. Lloyd (chairman of the section) presided. Mr. Reddie stated that whilst the production of alkali in sewage filters was exceptional, the experience of Bradford had always shown that this took place. Experiments had shown that it was probably due to a quantity of proteid and albuminoid matter in the sewage which resulted from the presence in it of such a large proportion of wool sud. A good deal of experimental work had been done with bacterial cultures, mixed cultures, and pure cultures, which showed that where the bacteria acted on proteid and albuminoid media considerable quantities of alkali were formed. The work done on pure cultures tended to further the theory that this was largely the cause of the production of alkali in sewage filters.

THE ANNUAL GENERAL MEETING of the West Riding Section of the Society of Dyers and Colourists was held at Bradford, on Thursday, April 19. Mr. B. Asquith presided. The Secretary (Mr. G. G. Hopkinson) reported that the progress of the Section during the past year had been very satisfactory. There was a possibility that a society similar to their own would be formed in Switzerland. Attention was drawn to the publication by the Society of a colour index in 13 parts, of which seven parts were now ready. Mr. Asquith said the publication had aroused great interest throughout the world, and orders had been received from Japan, Italy and America. The following officers were elected for the ensuing year: Chairman, Mr. H. Jennings; Vice-Chairman, Mr. B. Asquith; Secretary, Mr. G. G. Hopkinson; Assistant Secretary, Mr. S. Emmott; Committee, Messrs; J. H. Dunnington, F. Smith, W. P. Walker and F. Wilson (three years); E. Clayton, G. M. M. Chichester, R. Grice and N. E. Scafe (two years); and H. H. Bowen, S. Emmott, L. Turner and R. Turner (one year).

Fastness of British-made Dyes

A SECRET dyeing process discovered in Lancashire laboratories achieved what is claimed to be a record test during the Drapery and Textile Exhibition at the Agricultural Hall, London, which closed last week. For a fortnight cambrics, piqués, ratines and zephyrs in various pinks, blues, reds, greens and other shades were boiled in a mixture of strong soap and soda water. Not one, as a result of this strenuous treatment, showed signs of fading. "We began the test on the Monday the Exhibition opened," the demonstrator in charge stated, "and the materials have been boiled continuously ever since. The colours are all made by British dyemakers, and this process leaves them, for the entire life-time of the material, absolutely fast to boiling, bleaching, sunlight and the seaside air. It is all a question of how the colour is applied, and that, of course, is a strict secret."

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Abstracts of Complete Specifications

195,107. HYDROCARBONS, TREATMENT OF, BY HOT GASES. A. J. H. Haddan, London. From A. J. Paris, jun., Charleston, W. Va., U.S.A. Application date, September 24, 1921.

The process is for cracking hydrocarbons by means of the hot exhaust gases from internal combustion engines. The liquid hydrocarbon is supplied from a tank into the exhaust pipe of the engine where it is cracked, and the mixture passes through a part of the pipe which is surrounded by a cooling jacket to a separator. It is found that for each 50 ft. of gas or its equivalent burned in the engine, about one gallon of kerosene may be cracked by the exhaust gases. The products consist mainly of hydrocarbons of lower boiling point, water, acetic acid, and residual hydrocarbons. The lighter hydrocarbons are suitable as petrol substitutes. Small quantities of ammonia and alcohol are also obtained.

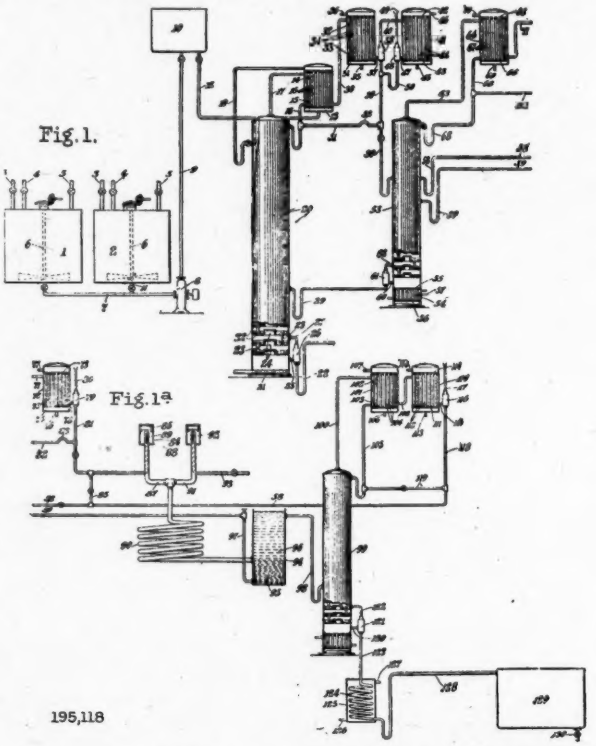
195,113. FACILITATING THE CLASSIFICATION OF MINERAL PARTICLES AND REDUCING LOSSES IN ORE DRESSING, BY THE AID OF CHEMICAL SUBSTANCES. R. H. Smythe, Roskear House, Camborne, Cornwall. Application date, September 14, 1922.

The process is for classifying mineral particles, finely divided ores, clays, graphite, etc., into grades, each composed of particles having similar weights but different sizes, according to their specific gravity. The process is particularly applicable for treating "slime" containing tin oxide. The ores or clays are suspended in a current of water, and a solution of aluminium sulphate or magnesium sulphate added, followed by lime water or ammonia. If clay containing hydrates is treated, the lime may be dispensed with. A gelatinous precipitate of aluminium or magnesium hydrate is formed which binds together the finer particles in a form in which they remain in suspension in a current of water. The water is run into a series of settling tanks, each provided with an agitator which detaches the mineral particles from the precipitate. The series may comprise three to five tanks, in which the graded material is collected. The finest material passes to the last tank, where it is treated with sulphuric, hydrochloric, nitric or acetic acid, to remove the excess of aluminium or magnesium hydrate. When the tanks are sufficiently full of precipitated material, mineral acid is added until the contents are slightly acid. The classified material may then be treated for the recovery of its mineral content by means of centrifugal or other apparatus.

195,117–8.—ESTERS, PROCESS AND APPARATUS OF PRODUCING HIGH GRADE. E. C. R. Marks, London. From U.S. Industrial Alcohol Co., 27, William Street, New York. Application date, November 11, 1921.

195,117. The object is to obtain esters, more particularly ethyl acetate, free from water, and of 100 per cent. purity. An alcohol, an organic acid, and a catalyst, are pre-heated and introduced into a column still which is heated by the injection of steam. The ester obtained is rectified to produce a constant boiling mixture of ester, alcohol, and water. This mixture is added to water, in which a layer containing a high percentage of ester separates, and this layer is then removed and rectified. The process is also applicable to other acids and alcohols, *e.g.*, butyric acid and methyl alcohol.

195,118. This specification describes the apparatus used in carrying out the process described in 195,117 above. Sulphuric acid, alcohol, and acetic acid are supplied through the pipes 3, 4, 5 to two mixing tanks 1, 2, which are used alternately. The proportions used are sulphuric acid of 50°–60° Bé. 0·3 parts, acetic acid of 8 per cent. strength 10 parts, and ethyl alcohol of 95 per cent. strength 0·8 part. The mixture passes through the pipe 7, pump 8, and pipe 9, to a tank 10, from which it passes through a pipe 12 through the tubes 16 of a combined dephlegmator and pre-heater 13. The mixture then passes through a pipe 19 to a column 20 maintained at a temperature of 80° C. at the top, by means of steam introduced through a perforated pipe 21 at the bottom. The liquid and steam pass in counter-current over a number of superposed trays 22. Alcohol of 70–90 per cent. strength is also supplied to the column through a pipe 29, from another part of the apparatus. The mixture of ethyl acetate, alcohol, and steam, passes through a pipe 17 to the dephlegmator and preheater 13 to heat it, and the condensate returns through the pipe 18. The vapour passes by a pipe 30 to a condenser 31 at a temperature of 60°–70° C., where a condensate consisting of ethyl acetate 10 per cent., alcohol



70 per cent., and water 20 per cent. is obtained. The vapour passes on to a condenser 41 cooled by cold water, and the condensate is collected in a receiver 48. The condensates from the receivers 38, 48 pass through a pipe 39 to a column 53, similar to the column 20, except that it is heated by steam tubes 57 to a temperature of about 70° C. at the upper end. Liquid is returned from the column 53 through a pipe 29 to the column 20, and vapour passes by a pipe 63 to a dephlegmator 64, cooled by cold water, and vapour passes on to the condenser 72. The condensate is a constant boiling mixture of ethyl acetate, 83 per cent., ethyl alcohol 9 per cent., and water 8 per cent., and passes through a pipe 78 to a receiver 79.

The liquid then passes by a pipe 81 to a measuring apparatus 84, and thence to a mixing coil 90 supplied with water from a measuring apparatus 92. The mixture then passes to a separator 94, where it divides into two layers. The upper layer consists of ethyl acetate 93 per cent., water 5 per cent., and alcohol 2 per cent. The lower layer, containing a small proportion of ethyl acetate, is returned to the column 53, and the upper layer passes to a drying column 99 similar to the column 53. The lower end of the column is maintained at 75° C., and vapour passes from the upper end to a dephlegmator 101 and condenser 109, from which the liquid may be returned through the pipe 58 to the column 53. Ethyl acetate of 95–100 per cent. strength passes through the pipe 123 to a cooling coil 124 and receiver 129.

195,153. RECOVERY OR SEPARATION OF COLLOIDAL MATTER FROM LIQUIDS, AND APPARATUS TO BE EMPLOYED THEREIN. T. W. Barber, 60, Barrackpore, Bengal, India. Application date, December 22, 1921. Addition to 132,947 (see THE CHEMICAL AGE, Vol. I., p. 555).

In this process the liquid containing the colloidal matter is caused to impinge against an opposed stationary or moving

body, which causes the particles of the colloid to cohere. A number of radial blades B are mounted on a shaft *b*, and rotated in the compartment A of the apparatus. The colloidal mixture is supplied through the inlet *c* to the compartment A^2, from which it passes through the perforations a^2 into the compartment A. The particles impinge against the blades B,

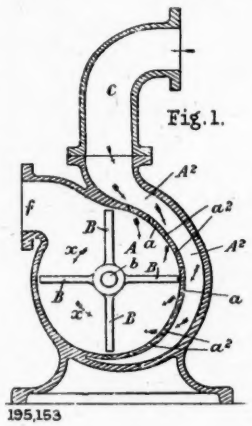


Fig. 1.

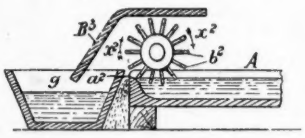


Fig. 3.

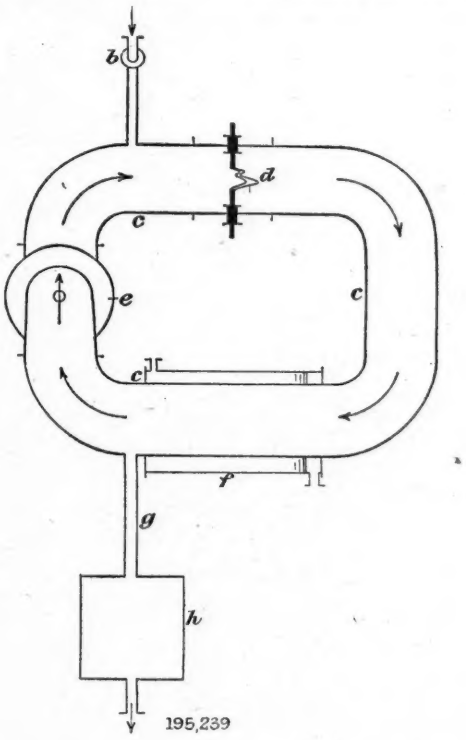
which are moving in the opposite direction, and are caused to cohere, and the separated material is discharged through the outlet *f*. Alternatively the mixture in a vessel A is subjected to the action of revolving pins b^2 having fine points, and the small particles of colloidal matter thus separated are projected against the baffle B^2 and collected in a vessel *g*.

195,181. TITANIUM PIGMENTS AND METHOD OF PRODUCING THE SAME. H. H. Buckman, 130, Copeland Street, Jacksonville, Fla., U.S.A. Application date, January 4, 1922.

The process is for producing complex compounds of titanium by means of hydrolysis of the sulphate or chloride. In the usual process, a weak acid solution of a titanium salt is heated to precipitate a complex titanium compound by hydrolysis. It is known that the rate of hydrolysis increases with the temperature, and it is now found that the nature of the precipitate produced may be greatly modified by use of high temperatures and to a lesser degree by high pressures. The hydrolytic precipitate obtained at a temperature of 100° C. is usually slimy, and it becomes tough on drying, but the precipitate obtained from the same solution at about 170° C. is dense, and dries to a smooth fine, white powder which is particularly suitable for use as a pigment. At these higher temperatures it is possible to use stronger acid solutions, so that the precipitation of impurities such as iron is prevented. The yield obtained from a given solution is much higher, and the time required for the hydrolysis is only about 1/5 to 1/10 of that necessary at low temperatures. In an example, a concentrated solution of titanium sulphate containing a small proportion of sulphuric acid is diluted with 1·5 times its volume of water, and heated to 100° C. for seven hours. The precipitate is filtered and air dried, and is a tough translucent substance. If a similar titanium sulphate solution is mixed with an additional 1–2 per cent. of concentrated sulphuric acid without dilution, and heated to 185° C. in an autoclave for 20 minutes, a very bulky precipitate is obtained which, when washed and air dried, is pure white and very dense. About double the yield is obtained at the higher temperature. It is found that the effect of a lower temperature with a higher pressure is less marked. The process may also be used for precipitating the complex compound on various base materials such as natural barytes, blanc fixe, natural gypsum, calcium sulphate, ground silica, magnesia, alumina or clay, to produce composite titanium pigments. The finely divided base material, *e.g.*, barium sulphate, is added to titanium sulphate solution and is heated in an autoclave. until the pressure reaches 250 lb. per sq. in. The hydrolysed compound is precipitated on the particles of barium sulphate, which is then washed and dried, and if necessary calcined. The hydrolysed precipitate may be produced in conjunction with other precipitates obtained from barium chloride, barium oxide, calcium chloride, calcium hydroxide, or phosphoric acid, by interaction with the titanium salt. If titanium sulphate is used, barium or calcium sulphates are precipitated, or a complex hydroxy salt of phosphorus and titanium in the case of phosphoric acid. The hydrolysed precipitate is particularly suitable for mixing with oils in the manufacture of paints and enamels, as a filler in the manufacture of rubber and linoleums, and as a lake pigment, etc. The product may also be mixed with white and red lead, lithopone white zinc, zirconium oxide, and other pigments without first being calcined.

195,239. ENDOTHERMIC GAS REACTIONS, PROCESS FOR CARRYING OUT. O. Y. Imray, London. From H. Andriessens, 14, Leonhardstrasse, Zürich, Switzerland, and The Soc. of Chemical Industry in Basle, Switzerland. Application date, February 23, 1922.

The object is to increase the yield in endothermic gas reactions which are effected by the use of the electric arc. It is known that the yield is increased the greater the fall of temperature of the gases leaving the arc. If this fall of temperature is obtained by increasing the speed at which the gases pass through the arc, the concentration of the product in the gases becomes so much reduced that difficulties are experienced in its recovery. In the present invention, the gases are caused to circulate continuously several times



through the heating element, and are cooled between each passage. The necessary fall of temperature from the arc is thus obtained, and the circulating gas is enriched with the product to such an extent that subsequent recovery is facilitated. The reaction gases are drawn into the system by a fan *b* into the pipe *c*, which forms a closed circuit containing the arc *d* and fan *e*. The gases leaving the arc are cooled by a cooling jacket *f*, and return to the fan *e*. The circulation may be continued for the necessary time, and the gas then passed through pipe *g* to an absorber *h*, while a fresh quantity of gas is introduced into the circuit. Alternatively, a certain proportion of circulating gas may be withdrawn from the circuit at each cycle and a corresponding quantity of fresh gas introduced. The process may also be used when a solid substance is to be treated in the arc, by introducing the substance into the gas current. When applied to production of oxides of nitrogen, a mixture of nitrogen one part and oxygen

two parts is circulated through the system at a speed of 20–25 metres per second, yielding nitric oxide.

195,290. Fatty Oils or the like, Process for Oxidising. R. Arends, 26, Enkweg, Wijhe, near Zwolle, The Netherlands. Application date, May 2, 1922.

An oil such as linseed oil is treated with preheated oxidising gases, preferably air, until the oil has reached a temperature not above 280° C. The heating is then stopped, and the passage of air through the oil continued until the product is of the required thickness. The process is applicable to linseed oil, unsaturated fats, fatty acids, fish oils, and any other vegetable or animal drying oil. The product may be mixed with paints without the necessity of first dissolving the oxidised oil. The air is preferably preheated to 300° C., and passed through the oil in a still until the oil is heated to 200° C., at which temperature it is maintained. The gases pass from the still to a cooler, in which the fatty acids are recovered.

195,295. Pure Alumina, Manufacture of. A. L. Pedemonte, 2, Rue Emile-Zola, Toulon, Var, France. Application date, May 5, 1922.

Ferruginous bauxite is heated to 350°–440° C. in a reducing atmosphere until the iron and titanium are reduced and rendered magnetic. The material is then passed through a magnetic separator to separate the magnetic particles, and the remaining silica and alumina are treated with hydrochloric or sulphuric acid to dissolve the alumina. The solution is evaporated, and the salt obtained is calcined to obtain anhydrous alumina and recover the acid. Any trace of titanium oxide remains with the silica when the alumina is dissolved in the acid.

Note.—Abstracts of the following specifications which are now accepted appeared in The Chemical Age, when they became open to inspection under the International Convention —173,757 (Gerb- und Farbstoffwerke H. Renner and Co., Akt.-Ges.) relating to manufacture of salts of sulphonated coumarone resins, see Vol. VI., p. 322; 174,077 (J. Weiss) relating to the production of low-temperature tar, semi-coke, and gas, from solid carbonaceous materials, see Vol. VI., p. 354; 174,078 (Farbwerke vorm. Meister, Lucius and Brüning) relating to preparation of arseno compounds, see Vol. VI., p. 354.

International Specifications not yet Accepted

193,385. Dyes. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, February 18, 1922.

A diazotised unsulphonated 4- or 6-nitro-2-aminophenol is coupled with 1-amino-5-oxynaphthalene-7-sulphonic acid in the presence of calicium hydroxide to obtain monoazo dyes which yield black shades on wool when after-chromed. Particulars are given of the dyeing properties of dyes from 4-nitro-, 4-nitro-6-chloro-, 6-nitro-4-chloro-, 6-nitro-4-methyl-, and 4-nitro-6-methyl- derivatives of 2-aminophenol.

193,420. Condensation Products of Formaldehyde and Urea. F. Pollak, 20, Langegasse, Vienna. International Convention date, February 18, 1922.

Condensation products of formaldehyde and urea, thiourea, or their derivatives, which at first are soluble, are mixed with urea, thiourea, or their derivatives, phenols or their derivatives, or hydrogen peroxide, which are capable of fixing or decomposing the excess of formaldehyde, and then heated to convert them into insoluble products. In an example, the initial soluble product is obtained by condensing urea with commercial formaldehyde in the presence of hexamethylene tetramine, and is then mixed with urea and sodium acetate, and heated to 60°-100° C. to render it insoluble. In another example the condensation product is replaced by dimethylolurea, which is dissolved in boiling water and heated with urea.

Latest Notification.

195,960. Process and apparatus for the manufacture and production of chemically-pure sulphuric acid. Verein für Chemische und Metallurgische Produktion. April 10, 1922.

Specifications Accepted, with Date of Application

195,655. Fertilisers. Plauson's (Parent Co.), Ltd. (*H. Plauson*). June 28, 1922.
195,675. Salt, Process for the Manufacture of. W. E. Gibbs. November 2, 1921.
195,677. Iron and steel, Method of making. T. Miyaguchi. November 3, 1921.
195,678. Ferro-boron and boron steel, Method of making. T. Miyaguchi. November 3, 1921.
195,688. Vanadium containing materials, Process of reducing. H. Wade. (*Vanadium Corporation of America*). November 30, 1921.
195,690. Dry-grinding solid materials to particles of a diameter of less than 0·008 mm., Method and Apparatus for. Plauson's (Parent Co.), Ltd. (*H. Plauson*). December 5, 1921.
195,710. Concentrating liquids, Process and apparatus for. E. Zahm. December 28, 1921.
195,711. Destructive distillation of coal and similar carbonaceous substances. T. M. Davidson and R. H. S. Abbott. December 29, 1921.
195,735. Gas washers and the like. F. G. Brockway. January 4, 1922.
195,738. Filtering apparatus. Thermal, Industrial and Chemical (T.I.C.) Research Co., Ltd., and J. S. Morgan. January 4, 1922.
195,753. Vat dyestuffs derived from anthraquinone, Manufacture of. O. Y. Imray. (*Soc. of Chemical Industry in Basle*). January 6, 1922.
195,778. Distillation of coal and other bituminous fuels, Apparatus for. G. Cantieny. January 11, 1922.
195,798. Hydrogen or gases rich in hydrogen, Manufacture of. J. H. West, A. Jaques and C. B. Tully. January 19, 1922.
195,849. Compositions or preparations with cellulose derivatives, Manufacture of. British Cellulose and Chemical Manufacturing Co., Ltd., W. Bader and W. A. Dickie. March 8, 1922.
195,876. Resolving water-in-oil emulsions, Process for. H. A. Gill. (*Sharples Specialty Co.*). April 25, 1922.
195,920. Cellulose acetate products, Treatment of. British Cellulose and Chemical Manufacturing Co., Ltd., and W. Bader. November 2, 1921.

Applications for Patents

Dartmoor China Clay Co., Ltd., and Gaudin, R. F. B. Bleaching kaolin, etc. 9,964. April 12.
Elektrizitätswerk Lonza. Process for preparation of urea salts from cyanamide. 9,900. April 11. (Germany, April 20, 1922.)
Franck, W., and Sulphur Akt.-Ges. Manufacture of sulphuric acid. 10,133. April 13.
Heyl, G. E. Obtaining sulphur-free oil from oil shale, etc. 9,897. April 11.
—— Boiler, etc., furnaces and distillation of oil shale, coal, etc. 10,204. April 14.
Hooper, L. D. Production of aluminium and silicon, etc., from clay, bauxite, etc. 10,165. April 14.
Imray, O. Y., and Soc. of Chemical Industry in Basle. Dyeing with sulphur dye-stuffs. 9,707. April 9.
—— Manufacture of mono-azo dye-stuffs. 9,708. April 9.
Jordan, L. A. Treatment of arsenious sulphide sludges for the separation of the sulphide. 9,737. April 10.
Mathesius, H. Production of titanium steel. 9,892. April 11.
Rider, D., and Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd. Dehydration and distillation of tar or oils. 9,779. April 10.
Stockman, H. A. Apparatus for distilling carbonaceous materials. 10,010. April 12.
Tyrer, D. Manufacture of phenol and phenolic bodies. 10,003. April 12.

Wages in the Glass Trade

In connection with the difficulty which has arisen in the glass trade (consequent upon the proposal of the employers to reduce wages and the refusal of the employees on a ballot to accept a reduction), Mr. Ryder, the chief conciliation officer of the Ministry of Labour for the Midland area, has intervened. The notices given to the men that the reduction would come into operation would have expired last week-end, but an invitation by Mr. Ryder to both sides to meet him in conference on Monday in Birmingham was accepted, and in view of this and to allow further time for negotiation, the Manufacturers' Association agreed that the notices be suspended for a week without prejudice to either side. The glassmakers, on a ballot vote, had overwhelmingly refused to accept a reduction of four shillings per week, and the employer subsequently gave 28 days' notice. The hope is entertained that Monday's conference may produce a satisfactory solution of the difficulty.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to* THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

London, April 26, 1923.

THERE has been a fairly steady turnover during the past week, although business has been far from good. Supplies from Germany are steadily dropping off, and such goods as are available are rapidly increasing in price.

Export limits are still largely not workable.

General Chemicals

ACETONE remains a firm market with steady inquiry.

ACID ACETIC is higher in price and in active demand.

ACID, CITRIC continues its upward course, and higher prices are expected.

ACID, FORMIC.—Little is obtainable and prices are likely to advance.

ACID, LACTIC.—Unchanged.

ACID OXALIC.—In better demand. Price is firmly maintained.

ACID TARTARIC has again advanced in price and the turnover is satisfactory.

ARSENIC.—Unchanged.

BARIUM CHLORIDE.—Quiet and uninteresting.

CREAM TARTAR has advanced in price and little is offering.

FORMALDEHYDE.—There is a steady demand of the hand to mouth variety, with prices unchanged.

LEAD ACETATE remains a better market at recent figures.

LITHOPONE is without special feature.

METHYL ALCOHOL is a little more plentiful, but otherwise without change in price.

POTASSIUM CARBONATE.—Unchanged.

POTASSIUM PERMANGANATE.—There is a fairly good demand, and supplies are short.

POTASSIUM PRUSSIATE is an active market. A reduction in price has stimulated demand.

SODIUM ACETATE is very scarce and has advanced in price.

SODIUM BICHROMATE is firm, and the foreign make is rapidly approaching the parity of the English article.

SODIUM HYPOSULPHITE is in steady demand, and the price shows an advancing tendency.

SODIUM NITRITE is only in fair demand, but price is firm.

SODIUM PRUSSIATE is lifeless.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID—Unchanged. An active market.

AMIDOL is a shade easier.

BARBITONE is scarce and firm.

CHLORAL HYDRATE is moderately active, slightly lower prices having been quoted by some holders.

GUAIACOL CARBONATE has advanced, higher prices are anticipated.

METHYL SALICYLATE is active and in good demand at current rates.

PHENACETIN is extremely firm and higher on the weak.

PHENOLPHTHALEIN has advanced further. Continental manufacturers are now asking much higher prices, which should have their effect upon this market shortly.

VANILLIN—Unchanged but firm.

Coal Tar Intermediates

Business continues on quiet steady lines and there are no outstanding features to report.

ALPHA NAPHTHOL.—Some small home trade business is passing and the price is firm.

ALPHA NAPHTHYLAMINE is steady and enquiries have been received.

ANILINE OIL has been of interest on export account and there is no change in the price.

BENZIDINE BASE.—Home trade business has been booked.

BETANAPHTHOL.—Some fair home trade enquiries have been received.

DIMETHYLANILINE.—A small home trade business.

DI NITRO CHLOR BENZOL.—Enquiries have been received both on home and export account.

DIPHENYLAMINE.—Some small home interest.

NAPHTHIONIC ACID has been in better demand.

NEVILE WINTHER ACID.—Some business has been placed.

PARANITRANILINE is quiet.

PARAPHENYLENEDIAMINE is steady.

XYLIDINE has been enquired for.

Coal Tar Products

The demand for most of the products is good, and in some cases prices have improved.

BENZOL 90% is in better demand, and to-day's values are 1s. 7d. to 1s. 8d. per gallon on rails, according to position.

PURE BENZOL is still neglected, and without change in value.

CREOSOTE OIL is steady, and business has been done at 8¾d. per gallon on rails at works, while 9¼d. to 10d. per gallon is asked in the South.

CRESYLIC ACID.—There is rather more inquiry, and prices are firm. Pale 97/99% quality is quoted at 2s. 2d. to 2s. 3d. per gallon on rails, and dark 95/97% at 1s. 10d. to 1s. 11d. per gallon on rails.

SOLVENT NAPHTHA is neglected, and is still quoted at 1s. 4d. per gallon.

HEAVY NAPHTHA.—There is very little demand, and the quotation of 1s. 5d. per gallon is unchanged.

NAPHTHALENES.—The better qualities are scarce for prompt delivery, and prices are very firm. 70/74 quality is worth £10 to £12 per ton, while hot pressed 76/78 is quoted at £14 10s. to £15 per ton.

PITCH remains quiet, and is slow of sale for prompt delivery. To-day's quotations may be taken as 190s. f.o.b. East Coast, and 190s. to 195s. per ton f.o.b. London.

Sulphate of Ammonia

There is no change in the position.

[Current Market Prices on following pages.]

The Swiss Calcium Carbide Industry

THE possible production of the seven Swiss carbide factories is close upon 120,000 tons of carbide yearly, of which, with the manufacture of manures, only about 10,000 tons are used in Switzerland itself, all the rest having to be exported. The export crisis and the import prohibitions and high duties of several countries have seriously affected the Swiss carbide factories and have led to the closing down of several large factories. The export of carbide, which amounted in 1919 to 37,000 tons, with a value of 20·2 million francs, fell in 1922 to 9,200 tons only, valued at 2·2 million francs, the chief purchasers being Belgium and Holland.

French Potash

THE volume of trade in French potash salts is now more restricted, as farmers have already obtained their potash requirements for the season, and apart from a fair demand for 20 per cent sylvinite, required for the turnip crop, sales in the more concentrated grades are becoming slower. Inquiries respecting the special grade finely ground French kainit now obtainable indicate the prospect of a fair demand in those districts where trials held last year showed it to be effective. Trade in the Colonies has come up to expectations, and in America Alsatian potash is finding a steady market.—*French Potash Mines Bureau.*

International Mining Exhibition

THE mining industries of Cornwall will be represented at the sixth International Mining Exhibition, which opens at the Royal Agricultural Hall, London, on June 1. Comprehensive exhibits will be sent illustrating the working of the clay and tin mines of the county.

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Current Market Prices

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	1	7	to	0	1	9
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	130	0	0	to	135	0	0
Acid, Acetic, glacial, 99–100%	ton	69	0	0	to	70	0	0
Acetic, 80% pure	ton	48	0	0	to	50	0	0
Acetic, 40% pure	ton	25	0	0	to	26	0	0
Arsenic, liquid, 2000 s.g.	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	55	0	0	to	60	0	0
Carbolic, cryst. 39–40%	lb.	0	1	8	to	0	1	9
Citric	lb.	0	1	10	to	0	1	10½
Formic, 80%	ton	52	10	0	to	53	0	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	41	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	44	0	0
Nitric, 80 Tw.	ton	27	0	0	to	28	0	0
Oxalic	lb.	0	0	6¾	to	0	0	7
Phosphoric, 1.5	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	1	9	to	0	2	0
Sulphuric, 92–93%	ton	6	0	0	to	7	0	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	5	to	0	1	5½
Alum, lump	ton	12	10	0	to	13	0	0
Chrome	ton	28	0	0	to	29	0	0
Alumino ferric	ton	9	0	0	to	9	5	0
Aluminium, sulphate, 14–15%	ton	8	10	0	to	9	0	0
Sulphate, 17–18%	ton	10	10	0	to	11	0	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
.880	ton	32	0	0	to	34	0	0
.920	ton	22	0	0	to	24	0	0
Carbonate	lb.	0	0	4	to	0	0	4½
Chloride	ton	50	0	0	to	55	0	0
Muriate (galvanisers)	ton	35	0	0	to	37	10	0
Nitrate (pure)	ton	35	0	0	to	40	0	0
Phosphate	ton	68	0	0	to	70	0	0
Sulphocyanide, commercial 90%	lb.	0	1	1	to	0	1	3
Amyl acetate	ton	175	0	0	to	185	0	0
Arsenic, white powdered	ton	70	0	0	to	75	0	0
Barium, carbonate, Witherite	ton	5	0	0	to	6	0	0
Carbonate, Precip.	ton	15	0	0	to	16	0	0
Chlorate	ton	65	0	0	to	70	0	0
Chloride	ton	17	0	0	to	17	10	0
Nitrate	ton	33	0	0	to	35	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	1	0	to	0	1	1
Bleaching powder, 35–37%	ton	10	10	0	to	11	0	0
Borax crystals	ton	28	0	0	to	32	0	0
Calcium acetate, Brown	ton	11	10	0	to	12	0	0
Grey	ton	19	15	0	to	20	0	0
Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	6	0	0	to	7	0	0
Carbon bisulphide	ton	35	0	0	to	40	0	0
Casein technical	ton	100	0	0	to	105	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	6
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	2	to	0	1	3
Sulphate	ton	27	0	0	to	28	0	0
Cream Tartar, 98–100%	ton	92	10	0	to	95	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	90	0	0	to	92	10	0
Formusol (Rongalite)	lb.	0	2	1	to	0	2	2
Glauber slats, commercial	ton	5	0	0	to	5	10	0
Glycerin crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal	0	2	2	to	0	2	3
Iron perchloride	ton	28	0	0	to	30	0	0
Sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	43	0	0	to	45	0	0
Carbonate (White Lead)	ton	45	0	0	to	48	0	0
Nitrate	ton	44	10	0	to	45	0	0
Litharge	ton	45	0	0	to	46	0	0
Lithophone, 30%	ton	22	10	0	to	23	0	0
Magnesium chloride	ton	5	10	0	to	6	0	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	6	10	0	to	7	0	0
Sulphate (Druggists')	ton	10	0	0	to	11	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	58	0	0	to	60	0	0
Methyl acetone	ton	71	0	0	to	75	0	0
Alcohol, 1% acetone	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt	ton	41	0	0	to	42	0	0
Ammonium sulphate, double salt	ton	41	0	0	to	42	0	0
Potash, Caustic	ton	33	0	0	to	34	0	0
Potassium bichromate	lb.	0	0	5½	to	0	0	6
Carbonate, 90%	ton	31	0	0	to	32	0	0
Chloride, 80%	ton	9	10	0	to	10	10	0
Chlorate	lb.	0	0	4¼	to	0	0	4½
Metabisulphite, 50–52%	ton	80	0	0	to	85	0	0
Nitrate, refined	ton	43	0	0	to	45	0	0
Permanganate	lb.	0	0	10	to	0	0	10½
Prussiate, red	lb.	0	4	3	to	0	4	4
Prussiate, yellow	lb.	0	1	5	to	0	1	5½
Sulphate, 90%	ton	10	10	0	to	11	0	0
Salammoniac, firsts	cwt.	3	3	0	to	—		
Seconds	cwt.	3	0	0	to	—		
Sodium acetate	ton	24	15	0	to	25	0	0
Arsenate, 45%	ton	48	0	0	to	50	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4½	to	0	0	4¾
Bisulphite, 60–62%	ton	21	0	0	to	23	0	0
Chlorate	lb.	0	0	3½	to	0	0	3¾
Caustic, 70%	ton	19	10	0	to	20	0	0
Caustic, 76%	ton	20	10	0	to	21	0	0
Hydrosulphite, powder	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial	ton	10	10	0	to	11	0	0
Nitrite, 96–98%	ton	28	0	0	to	29	0	0
Phosphate, crystal	ton	16	0	0	to	16	10	0
Perborate	lb.	0	1	0	to	0	1	1
Prussiate	lb.	0	0	9	to	0	0	9½
Sulphide, crystals	ton	10	10	0	to	11	0	0
Sulphide, solid, 60–62 %	ton	16	10	0	to	17	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	50	0	0	to	55	0	0
Nitrate	ton	40	0	0	to	42	0	0
Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Flowers	ton	11	10	0	to	12	10	0
Roll	ton	11	0	0	to	12	0	0
Tartar emetic	lb.	0	1	2	to	0	1	3
Tin perchloride, 33%	lb.	0	1	2	to	0	1	4
Perchloride, solid	lb.	0	1	5	to	0	1	7
Protochloride (tin crystals)	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.	ton	21	0	0	to	22	10	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	40	0	0	to	42	0	0
Dust, 90%	ton	45	0	0	to	47	10	0
Sulphate	ton	16	0	0	to	17	0	0

Pharmaceutical Chemicals

Acetyl salicylic acid	lb.	0	3	3	to	0	3	6
Acetanilid	lb.	0	1	6	to	0	1	9
Acid, Gallic, pure	lb.	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	9	to	0	3	0
Salicylic, B.P.	lb.	0	2	2	to	0	2	6
Tannic, leviss	lb.	0	3	4	to	0	3	6
Amidol	lb.	0	8	3	to	0	8	6
Amidopyrin	lb.	0	13	3	to	0	13	6
Ammon ichthosulphonate	lb.	0	2	0	to	0	2	3
Barbitone	lb.	0	18	0	to	0	18	6
Beta naphthol resublimed	lb.	0	1	9	to	0	2	0
Bromide of ammonia	lb.	0	0	8½	to	0	0	9½
Potash	lb.	0	0	8	to	0	0	9
Soda	lb.	0	0	8½	to	0	0	9½
Caffeine, pure	lb.	0	12	0	to	0	12	3
Calcium glycerophosphate	lb.	0	5	9	to	0	6	0
Lactate	lb.	0	2	0	to	0	2	3
Calomel	lb.	0	4	9	to	0	5	0
Chloral hydrate	lb.	0	3	10½	to	0	4	0
Cocaine alkaloid	oz.	0	18	0	to	0	18	6
Hydrochloride	oz.	0	14	9	to	0	15	0
Corrosive sublimate	lb.	0	4	3	to	0	4	6
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	1	6	to	0	1	6½
B.P. (75–80% eucalyptol)	lb.	0	1	7	to	0	1	7½
Guaiacol carbonate	lb.	0	8	6	to	0	8	9
Liquid	lb.	0	9	6	to	0	10	0
Pure crystals	lb.	0	10	3	to	0	10	6
Hexamine	lb.	0	4	3	to	0	4	6
Hydroquinone	lb.	0	3	9	to	0	4	0
Lanoline anhydrous	lb.	0	0	7	to	0	0	7½
Lecithin ex ovo	lb.	0	18	6	to	1	0	0
Lithi carbonate	lb.	0	9	6	to	0	10	0
Methyl salicylate	lb.	0	2	6	to	0	2	10
Metol	lb.	0	9	6	to	0	10	0
Milk sugar	cwt.	4	15	0	to	5	0	0
Paraldehyde	lb.	0	1	6	to	0	1	9
Phenacetin	lb.	0	6	0	to	0	6	6
Phenazone	lb.	0	7	9	to	0	8	0
Phenolphthalein	lb.	0	5	6	to	0	5	9
Potassium sulpho guaiacolate	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.	oz.	0	2	3		—		

	Per	£	s.	d.		£	s.	d.
Resorcine, medicinal	lb.	0	5	3	to	0	5	6
Salicylate of soda powder	lb.	0	2	6	to	0	2	9
Crystals	lb.	0	2	9	to	0	3	0
Salol	lb.	0	2	9	to	0	3	0
Soda Benzoate	lb.	0	2	3	to	0	2	6
Sulphonal	lb.	0	14	0	to	0	14	6
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	12	0	to	0	12	6
Soda salicylate	lb.	0	7	9	to	0	8	3
Vanillin	lb.	1	3	6	to	1	4	6

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	2	0	to	0	2	3
Refined	lb.	0	2	6	to	0	2	9
Alphanaphthylamine	lb.	0	1	6	to	0	1	7
Aniline oil, drums extra	lb.	0	0	9½	to	0	0	10
Salts	lb.	0	0	9½	to	0	0	10
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	0	to	0	3	3
Benzidine, base	lb.	0	5	0	to	0	5	3
Sulphate	lb.	0	3	9	to	0	4	0
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical	lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	6	to	0	4	9
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	4	to	0	1	5
Dinitrophenol	lb.	0	1	7	to	0	1	9
Dimethylaniline	lb.	0	3	0	to	0	3	3
Diphenylamine	lb.	0	3	9	to	0	4	0
H-Acid	lb.	0	5	0	to	0	5	3
Metaphenylenediamine	lb.	0	4	0	to	0	4	3
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7)	lb.	0	5	6	to	0	6	0
Naphthionic acid, crude	lb.	0	2	3	to	0	2	6
Naphthionate of Soda	lb.	0	2	6	to	0	2	9
Naphthylamin-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Nevill Winther Acid	lb.	0	7	3	to	0	7	9
Nitrobenzol	lb.	0	0	8	to	0	0	8
Nitronaphthalene	lb.	0	1	0	to	0	1	1
Nitrotoluol	lb.	0	0	8	to	0	0	9
Orthoamidophenol base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	0	10	to	0	0	11
Orthonitrotoluol	lb.	0	0	3	to	0	0	4
Para-amidophenol, base	lb.	0	8	6	to	0	9	0
Hydrochlor	lb.	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	2	7	to	0	2	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	12	6
Paratoluidine	lb.	0	5	9	to	0	6	3
Phthalic anhydride	lb.	0	2	6	to	0	2	9
Resorcin, technical	lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude	lb.	0	0	10	to	0	0	11
Tolidine, base	lb.	0	7	3	to	0	7	9
Mixture	lb.	0	2	6	to	0	2	9

Essential Oils and Synthetics

The market this week has been very quiet, with practically no business passing. There are no changes of any sort to report.

Essential Oils.		£	s.	d.
Anise	c.i.f. 1/10 spot	0	2	0
Bay		0	12	0
Bergamot		0	12	0
Cajaput		0	3	9
Camphor, white	per cwt.	4	0	0
Brown	"	3	15	0
Cassia	c.i.f. 7/9 spot	0	8	3
Cedarwood		0	1	6
Citronella (Ceylon)		0	3	2
(Java)		0	4	0
Clove		0	7	6
Eucalyptus		0	1	6
Geranium Bourbon		1	8	0
Lavender		0	12	6
Lavender spike		0	3	0
Lemon		0	3	0
Lemongrass	per oz.	0	0	2¾
Lime (distilled)		0	3	3
Orange sweet (Sicilian)	firmer	0	11	0
(West Indian)		0	9	6
Palmarosa		0	17	6
Peppermint (American)		0	13	0
Mint (dem. ntholised Japanese)		0	6	3
Patchouli		1	12	0
Otto of Rose	per oz.	1	4	0
Rosemary		0	1	8
Sandalwood		1	6	0
Sassafras		0	5	0
Thyme	according to quality 2/6 to	0	8	0

Synthetics.			
Benzyl acetate	0	3	0
Benzoate	0	3	0
Citral	0	10	0
Coumarine	0	15	0
Heliotropine	0	7	0
Ionone	1	5	0
Lianlyl acetate	1	2	6
Methyl salicylate	0	2	6
Musk xylol	0	9	0
Terpeniol	0	3	1

Restrictions on Insulin

THE Medical Research Council, in a further statement on Insulin and the treatment of diabetes, indicate that British Drug Houses, Ltd., in conjunction with Messrs. Allen and Hanburys, and Messrs. Burroughs, Wellcome, and Co., are now making insulin under supervision by the Medical Council. It is hoped that three other firms will soon be able similarly to manufacture insulin. Further supplies will this week be available from America.

Owing to the shortage of present supplies, the Council are imposing certain restrictions upon the use of insulin by hospitals and practitioners :—

1. Careful correlation will be made of the diet, of the blood-sugar changes, and of the insulin dosage in each case. For at least one group of cases it is known already that the insulin dosage can be reduced progressively with suitable adjustment of diet. This reduction allows economy of insulin, besides the advantage it may bring to the patient.

2. Insulin will not be given to those whose symptoms can be controlled by moderate restrictions of diet. There should be no luxury use of insulin till supplies are abundant.

3. It is understood, of course, that in emergency, and apart from the careful correlation just mentioned, insulin will be given to those in diabetic coma, or those nearly approaching it, and it may be given to those with diabetic symptoms needing special preparation for some surgical operation.

4. Care will be taken to avoid the danger of giving insulin to non-diabetic cases (*e.g.*, to patients with renal glycosuria).

Presentation to Managing Director

A PRESENTATION of a chiming clock has recently been made to the managing director of Electro Bleach and By-Products, Ltd., Middlewich (Mr. Stainer Hutchins), by the whole of the employees. The object of the presentation was to give expression to the good feeling which exists, and the pleasure at Mr. Hutchins' decision to continue his connection with the company. Mr. Chamberlain, secretary of the company, expressed the confidence which the employees of every grade had in Mr. Hutchins and their appreciation of his decision to remain at Middlewich. The presentation was made by Mr. Stephens, chairman of the Works Committee, in a few well-chosen words. In accepting the gift, Mr. Hutchins referred to the progress of the company during the past nine years and to the good feeling existing between himself and the employees, the relationship being that of a happy family. He thanked them for the handsome gift, which would at all times remind him of his happy associations with Middlewich. The inscription on the clock reads :—" Presented to Stainer Hutchins, Esq., by the employees of the Electro Bleach and By-Products, Ltd., Middlewich, as a token of appreciation and esteem of his interest in their welfare."

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, April 25th, 1923

BUSINESS in the heavy chemical market continues quiet, and there is no change of importance to record.

Industrial Chemicals

ACID, ACETIC.—Glacial, 98/100%, £63 to £69, per ton; 80% pure, £47 to £48 per ton; 80% technical, £45 to £47 per ton, c.i.f. U.K.

ACID, BORACIC.—Crystal or granulated, £55 per ton; powdered, £57 per ton, carriage paid U.K.

ACID, CARBOLIC.—Inclined to be easier at 1s. 7d. per lb.

ACID, CITRIC.—B.P. crystals; spot parcels quoted 1s. 8d. to 1s. 9d. per lb.

ACID, FORMIC, 80%.—In moderate demand at about £56 per ton, ex store.

ACID, HYDROCHLORIC.—Makers' price unchanged 6s. 6d. per carboy, ex works.

ACID, NITRIC, 84°.—£27 10s. per ton, ex station, full truck loads.

ACID, OXALIC.—Quoted 6¾d. to 7d. per lb., ex store.

ACID, SULPHURIC.—144°, £3 15s. per ton; 168°, £7 per ton, ex works, full load. De-arsenicated quality, £1 per ton more.

ACID, TARTARIC.—Remains unchanged at about 1s. 2½d. per lb.

ALUM, LUMP POTASH.—Offered from Continent at about £11 per ton, c.i.f. U.K. Spot lots, £12 10s. per ton, ex store.

AMMONIA, ANHYDROUS.—In good demand and unchanged at 1s. 6d. per lb.

AMMONIA, CARBONATE.—Good export inquiry. Lump, 4d. per lb.; ground, 4½d. per lb., delivered.

AMMONIA, LIQUID, 880°.—Offered at 3½d. per lb., delivered, drums extra.

AMMONIA, MURIATE.—Grey galvanisers quality, £31 to £32 per ton, f.o.r. works.

AMMONIA, SULPHATE.—25¼%, £15 10s. per ton; 25¾%, neutral, £16 13s. per ton, ex works, April/May.

ARSENIC, WHITE POWDERED.—Very little inquiry. Price remains about £76 per ton, ex store.

BARIUM CARBONATE.—98/100% precipitated offered at £16 per ton, ex station.

BARIUM CHLORIDE, 98–100 per cent.—Continental make about £14 15s. per ton, c.i.f. U.K. English material now quoted £17 per ton.

BARYTES.—Finest white English, £5 5s. per ton, ex works.

BLEACHING POWDER.—£11 10s. per ton, ex station, spot delivery; contracts 20s. per ton less.

BORAX.—Crystal or granulated, £28 per ton; powdered, £29 per ton, delivered U.K. stations.

CALCIUM CHLORIDE.—English makers' price, £5 15s. per ton, ex quay or station; Continental about £5 5s. per ton, ex store.

COPPERAS, GREEN.—Good export inquiry. Quoted £2 10s. per ton, f.o.b. U.K.

FORMALDEHYDE, 40 per cent.—Offered for early delivery at £87 per ton, ex wharf.

GLAUBER SALTS.—Finest white crystals, £3 17s. 6d. per ton, ex store.

LEAD, RED.—English makers' price reduced 20s. per ton, now £42 per ton, carriage paid U.K.; Continental about £36 10s. per ton, ex store.

LEAD, WHITE.—Moderate export inquiry. Dry white lead quoted £36 10s. per ton, f.o.b. U.K.

LEAD ACETATE.—White crystals now quoted £41 per ton, ex store, spot delivery.

MAGNESITE, GROUND CALCINED.—Unchanged at £8 10s. per ton, ex station.

MAGNESIUM CHLORIDE.—Quoted £4 5s. per ton, ex store, spot delivery; offered from Continent at £3 2s. 6d., c.i.f. U.K.

MAGNESIUM SULPHATE (Epsom Salts).—Commercial, £7 per ton; B.P., £8 10s. per ton, delivered; quoted, £6 10s. per ton, f.o.b. for export.

POTASH, CAUSTIC, 88/92%.—Spot lots about £35 per ton, ex store.

POTASSIUM, BICHROMATE.—Moderate export inquiry. Price for home consumption, 5¾d. per lb. delivered.

POTASSIUM CARBONATE.—96/98% now quoted £34 per ton; 90/92%, £30 per ton, ex store, spot delivery.

POTASSIUM CHLORATE.—Crystals or granulated, 3d. per lb., ex store, little demand.

POTASSIUM NITRATE (Saltpetre).—Nominally £32 per ton. Practically no inquiry.

POTASSIUM PERMANGANATE.—B.P. crystals about 11¼d. per lb.; commercial, 10d. to 10½d. per lb., ex store. Supplies scarce.

POTASSIUM PRUSSIATE (Yellow).—Quoted 1s. 5d. to 1s. 5¼d. per lb. Moderate inquiry.

POTASSIUM SULPHATE.—Price about £7 10s. to £8 per ton, basis 80% f.o.r. works.

SODA CAUSTIC.—76/77%, £21 10s. per ton; 70/72%, £20 per ton; 60/62%, broken, £21 5s. per ton; 98/99 per cent. powdered, £24 17s. 6d. per ton, ex station, spot delivery.

SODIUM ACETATE.—Now quoted £25 10s. per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb., delivered.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station. Alkali, 58%, £8 17s. 6d. per ton, ex quay or station. Good export inquiry.

SODIUM CHLORATE.—Remains unchanged at 3d. per lb.

SODIUM HYPOSULPHITE.—Commercial about £10 10s. per ton; pea crystals, £15 10s. per ton, ex station. Continental slightly less.

SODIUM NITRATE.—Refined, 96/98% about £13 10s. per ton, f.o.r. or f.o.b. U.K.

SODIUM NITRITE, 100%.—£27 to £29 per ton, according to quantity.

SODIUM PRUSSIATE (YELLOW).—Price about 8½d. to 8¾d. per lb. ex store little inquiry.

SODIUM SUPHATE (SALTCAKE 95%).—Price for home consumption £4 per ton, delivered station. Good export inquiry.

SODIUM SULPHIDE, 60/62%.—English make about £15 15s. per ton, for solid in drums. Broken, 20s. per ton more.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £8 per ton; ground, £8 per ton. Prices nominal.

ZINC CHLORIDE.—98% solid quoted £26 to £27 per ton, f.o.b. U.K.

ZINC SULPHATE.—White commercial £14 10s. per ton, delivered station.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—Good demand both for home and foreign. Price quoted 1s. 6½d. lb. delivered or f.o.b.

BENZIDINE BASE.—Export inquiry. Price 6s. 6d. per lb. 100% basis f.o.b.

BETA NAPHTHOL.—Good inquiries both for home and export. Price 1s. 1d. per lb. delivered or f.o.b.

CLEVES ACID.—Export inquiry. Price 4s. per lb. 100% basis.

CHROMOTROPE ACID.—Export inquiry. Price quoted 10s. 6d. per lb. 100% basis.

DINITROCHLORBENZOL.—Inquiry for export. Price quoted £95 per ton f.o.b.

GAMMA ACID.—Small home inquiry. Price quoted 13s. 9d. per lb. 100% basis, carriage paid.

H ACID.—In good demand. Price 5s. per lb. 100% basis, delivered or f.o.b.

METAPHENYLENEDIAMINE.—Export inquiry. Price quoted 5s. 6d. per lb. 100 % basis.

NAPHTHIONATE OF SODA.—In strong demand. Price quoted 2s. 8½d. per lb. 100% basis.

PARAPHENYLENEDIAMINE.—Export inquiry. Price 12s. 6d. per lb. 100% basis.

S S ACID.—Small home inquiry. Price 16s. 8d. per lb. 100% basis.

TOLIDINE.—Fair export demand. Price quoted 7s. 3d. per lb. 100% basis.

Manchester Chemical Market

(From Our Own Correspondent.)

Manchester, April 26, 1923.

There has been little alteration in the condition of the chemical market. Business here has been carried on on a quietly steady scale, home consumers taking fairly good supplies of some of the leading lines of "heavies," while trade overseas has been reasonably active having regard to the general condition of things, the Dominions being the principal buyers. Prices all round are distinctly firm, with a tendency in certain lines, particularly those affected by the Ruhr occupation, towards further advance.

Heavy Chemicals

Caustic soda has been well maintained at a level of £19 per ton for 60 per cent., and £21 10s. for 76–77 per cent. strength; a satisfactory home and foreign business in this material has been put through. Bleaching powder is still in good demand for home trade purposes, and price is firm at £11 10s. per ton; for export a steady inquiry is being met with. Soda crystals continue quiet at £5 5s. per ton delivered. Saltcake is in fairly active request both for home and export; home consumption price is unchanged at £4 10s. per ton. There has been little or no improvement in the demand for sodium sulphide, though prices are steady at £14 10s. to £15 per ton for 60–65 per cent. concentrated solid, and £9 to £9 10s. for crystals. Glauber salts are quiet but steady at £4 per ton. Bicarbonate of soda is in steady demand at £10 10s. per ton delivered to home users. Alkali is still being actively called for both by home and foreign users; home trade price is unchanged at £7 12s. 6d. per ton for 58 per cent. material. Hyposulphite of soda is only in moderate demand at £15 per ton for photographic crystals and £10 for commercial. Nitrite of soda is quiet but steady at £26 10s. to £27 per ton. Phosphate of soda is firm at £15 per ton, but little business is being put through. Chlorate of soda meets a fairly steady demand at 3d. per lb. Prussiate of soda is still only a quiet section, though the price is steady at 8½d. per lb. Bichromate of soda is unchanged at 4½d. per lb., with buyers taking moderate supplies. Acetate of soda is quiet at £24 per ton.

Caustic potash is in good request and very firm at £34 10s. per ton for 88–90 per cent. Carbonate of potash is dearer at £33 to £34 per ton for 96–98 per cent. material, a good inquiry being experienced. Bichromate of potash is fairly active at 5¾d. per lb. Yellow prussiate of potash is dull and rather easier at about 1s. 5d. per lb. Chlorate of potash is firm at 3½d. per lb., a fairly steady demand being met with. Permanganate of potash is strongly maintained at the recent advance to round 10d. per lb.

Sulphate of copper is finding a better market for export and prices are steady at £26 10s. to £27 per ton. Arsenic, also, is still being readily taken up for shipment, and with supplies short prices are very firm at £75 per ton for white powdered, Cornish makes. Commercial Epsom salts are in better demand at about £6 10s. for British makes, with foreign quoted at a lower figure; magnesium sulphate, B.P., is steady at round £7 per ton. Acetate of lime is still scarce and firm at £20 for grey and £10 10s. per ton for brown. Nitrate of lead is inactive at £43 10s. per ton. White sugar of lead is in short supply, and as the demand is steady quotations are higher at about £45 per ton, with £40 per ton asked for brown.

Acids and Tar Products

Tartaric acid is firm and in good request at 1s. 2½d. to 1s. 3d. per lb. Citric acid, B.P. crystals, is also fairly active at 1s. 8d. to 1s. 8½d. per lb. Acetic acid finds a ready sale at £70 per ton for glacial and £47 to £48 for 80 per cent. technical. Oxalic acid is still a dull section, though the price is steady at round 6½d. per lb.

Coal-tar products generally are quieter. The nominal quotation for pitch is still between £9 and £9 10s. per ton f.o.b. Manchester, but buyers seem to be less inclined to pay these high prices. Carbolic acid crystals are quiet and easier at 1s. 6d. to 1s. 7d. per lb.; crude, 60 per cent., is about unchanged at 3s. 9d. to 4s. per gallon. Benzole is still quiet but steady at 1s. 8d. per gallon. Solvent naphtha is firm at 1s. 8d. to 1s. 9d., but little business is being done. Creosote oil is in fair demand at 10½d. per gallon. Naphthalenes, also, are in good request; refined is steady at £20 per ton, with crude at £6 to £13.

Chemical Matters in Parliament

Coke Ovens

In reply to a question by Mr. Hardie (House of Commons, April 23) Lieut.-Colonel Lane-Fox said that the number of coking ovens idle in Great Britain in March was about 2,000.

Export Credits Department

Sir Park Goff (House of Commons, April 18) asked whether it was proposed to extend the term of the operation of the Export Credits Department, which was due to terminate in September, in view of the dearth of new orders to exporters. The Parliamentary Secretary to the Board of Trade (Viscount Wolmer) replied that no decision had yet been arrived at in the matter.

British Trade in the Ruhr District

Mr. Willey (House of Commons, April 18) asked how many complaints had been received from British firms whose business was seriously affected by the delays in transport and delivery due to the situation in the Ruhr; and what new steps were being taken to relieve their anxiety in view of the possibility of the increase of unemployment in this country.

Viscount Wolmer replied that the number of complaints received was over 600. His Majesty's Government were doing their utmost to arrange with the Allied Governments and the German Government terms on which contracts entered into by British traders before the occupation of the Ruhr might be fulfilled, but he regretted to say that at the moment the deadlock continues.

Trade in Germany

Lord H. Cavendish-Bentinck (House of Commons, April 23) asked the President of the Board of Trade whether he was aware that last week the Inter-Allied Rhineland High Commission at Coblentz, under the chairmanship of Lord Kilmarnock, advised a member of the British Chemical Trade Association that if his firm desired to obtain delivery of their goods lying at Cologne they must pay the 10 per cent. Franco-Belgian Reparation Tax, and that since all goods consigned from Germany to the United Kingdom upon importation are liable to a tax of 26 per cent. *ad valorem* under the German Reparation (Recovery) Act, payable by the German Government, these goods were liable to a total levy of 36 per cent., whereas goods going to Belgium or France only paid 10 per cent.

Lieut.-Colonel Buckley replied that he was not aware of the communication mentioned in the first part of the question. It was, however, correct that goods exported from Cologne, as from other parts of German occupied territory, must, if they were subject to export licence requirement, pay export duty to the Franco-Belgian authorities, such duty at present being in nearly all cases 10 per cent. *ad valorem*. He was, however, informed that it had been decided to reintroduce as from May 1 the German export tariff as it was in October, 1921. As regards the last part of the question, he pointed out that the 26 per cent. Reparation Levy did not act as a tax on German goods imported into this country, so long as the German Government carried out their obligation to refund the amount of the levy to the German exporter; and no specific case of the German Government having refused to reimburse the amount had been brought to his notice.

Necol Plastic Wood

Wood in a plastic condition is somewhat in the nature of a novelty, but it is now a manufactured product that should be useful in trades where wood is ordinarily used. The manufacturers are Necol Industrial Collodions, Ltd., of Stowmarket, and Windsor House, Victoria Street, London, S.W.1. The preparation is known as "Necol Plastic Wood." It is presumably some preparation of cellulose, but the process of manufacture is not, of course, indicated by the firm, which is a branch of Nobel Industries, Ltd. It may be moulded in the soft state and worked like ordinary wood when dry. The drying may be carried out in steam-heated ovens, and is accompanied by a small contraction in volume. Probably its greatest use is in cabinet making, etc., and also in the engineering pattern shop, although it should also prove useful in electrical work, as it is a good insulating material. The property which renders it most useful in these directions is its ability to adhere firmly to a properly cleaned surface, whether of wood, metal, or stone.

Company News

BRYANT AND MAY, LTD.—The transfer books of the company are closed until May 9.

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA, LTD.—The transfer books and register of holders of the 8 per cent. first mortgage debentures of the company will be closed from May 1 to 14 inclusive.

DAY AND MARTIN, LTD.—It is announced that Messrs. Carr and Son, of New Southgate, have purchased the business of Day and Martin, Ltd., the old-established and well-known firm of blacking manufacturers.

ANTON JURGENS' UNITED (MARGARINE) WORKS.—The directors announce that at the forthcoming annual meeting they will propose a full dividend of 6 per cent. on various descriptions of preference shares. No distribution, however, will be recommended on the ordinary shares.

ANGLO-AMERICAN OIL CO., LTD.—The directors have resolved to pay a final dividend of 2s. per share, free of tax, making a total of 15 per cent. for the year 1922, payable on and after May 15, by the National Provincial Bank of England, Ltd., or by the Guaranty Trust Company of New York.

TARAPACA AND TOCOPILLA NITRATE CO.—Dividends for the year 1922 are announced at the rate of 10 per cent. less tax, on the old shares, and 5 per cent., less tax, on the new shares—the latter, issued in May last, ranking for only a portion of the year. For 1921 a dividend of 10 per cent. was paid.

ANGELA NITRATE CO.—The gross profit for 1922 was £12,122. After deducting London expenses, £2,220, and charging stoppage of works expenses, £6,622, repairs to plant, etc., £2,208, there remains £1,071, which, with £6,933 brought in, makes a total of £8,004. The directors propose a further dividend of 5 per cent., making 10 per cent. for the year, payable on May 4, leaving £1,004 to be carried forward.

ANGLO-CHILIAN NITRATE AND RAILWAY CO.—The directors announce a dividend of 2s. per preference share (being 10 per cent.) and 2s. per ordinary share (being 10 per cent.), both free of tax, payable on May 11, making 15 per cent. for the year. Coupons due on May 1 on the 4½ per cent. consolidated mortgage bonds will be paid on and after that date at the Anglo-South American Bank, Ltd., 62, Old Broad Street, London.

OLYMPIC PORTLAND CEMENT CO.—The net profit for 1922 was £67,543, and £15,205 was brought in, making a total of £82,748, which is disposed of as follows: To debenture redemption sinking fund, £6,432; to depreciation, £4,414; to reserve, £30,000. The directors propose a final dividend of 7 per cent., less tax, making 12 per cent. for the year, leaving the sum of £19,727 to be carried forward. The annual meeting will be held at 7, Gracechurch Street, London, on May 3, at 3 p.m.

BELL'S UNITED ASBESTOS CO., LTD.—The directors have resolved to recommend to the shareholders at the general meeting, to be held on May 10, the payment of a balance dividend of 1s. 6d. per share on the ordinary shares of the company, which, with the interim dividend paid in October last, makes a total distribution of 10 per cent. for the year. After providing for Income Tax and Corporation Profits Tax, the amount to be carried forward is £37,910, an increase of £3,897. The transfer book and register of the ordinary shares will be closed from May 2 to 11 inclusive.

BABCOCK AND WILCOX, LTD.—The accounts for 1922 show a net profit of £787,601, to which has to be added the balance of £71,243 brought forward, making a total of £858,844. After paying the dividends on the preference issues, the directors recommend a further dividend of 9 per cent. on the ordinary shares plus a bonus of 3 per cent., both free of tax, making 20 per cent. for the year. It is proposed to place £200,000 to reserve and £20,000 to the staff pension fund, leaving £194,126 to be carried forward. The annual meeting will be held at Babcock House, 34, Farringdon Street, London, on May 1, at 12.30 p.m.

ENGLISH CHINA CLAYS, LTD.—The net profit for the year 1922 was £62,342, as compared with a loss of £32,102 for the preceding year, the result being arrived at after making all usual provisions for amortisation of leases, depreciation, and bringing down the valuation of stocks to basis of present costs of production. The profit for the year is sufficient to enable the company to pay off the arrears of dividend on the preference shares and to pay the dividend on these shares for the year ended December 31 last. The debit balance brought forward from the preceding year was £5,350, and after payment of the dividend on the preference shares, there is a credit balance to carry forward of £15,354.

SALAR DEL CARMEN NITRATE CO.—The report for the past year states that the gross profit amounts to £70,016, from which is deducted London office expenses of £4,812 and the sum set aside for taxation of £7,000, leaving a net profit of £58,204. In addition to this sum £18,577 was brought forward, thereby raising the total available to £76,781. The interim dividend of 5 per cent. paid in November last absorbed £8,112, while the final distribution now recommended of 20 per cent. will require £32,450. It is also proposed to transfer £15,000 to reserve, and to apply £5,000 in reduction of plant and machinery account. These allocations permit a balance of £16,218 to be carried forward. The profits have been realised on 640,959 Spanish quintals of nitrate, and the stock unsold at December 31 last of 132,568 quintals has been taken into the accounts at cost.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. No.
Italy	Anhydrous sulphate of soda ..	510
New Orleans ..	Fertilising materials, palm oil, etc.	524
Buenos Aires	Centrifugal pumps.....	D.O.T. 7857/ F.L./E.C./2
Colombia	Paints and varnishes	527
Montreal	Distilling and refining machinery for the production of alcohol	11007/E.D. C.C./2
Montreal	Paris green, arsenate of lead, coarse salt and superphosphate	—
New Zealand..	Drugs, medical and surgical materials, etc.	534
New Zealand..	Heavy chemicals, aluminium ware	535
South Africa ..	Arsenite of soda	11059/E.D./ C.C./2
Zurich.....	Pharmaceutical and druggists' specialities	19094/ F.W./C.C.
Buenos Aires..	Chemicals, coal tar oil, etc.....	559

Recent Wills

Mr. John Glen, of Kilkerran Chemical Works, Maybole, Scotland..... £3,036

Mr. George Miller, Beddington Corner, Mitcham, Surrey, senior partner of Messrs. J. and G. Miller, distillers of essential oils..... £23,098

Alderman Henry Alfred Hubbersty, Burbage Hall, Buxton, chairman of the Buxton Lime Firms' Co., Ltd. £60,349

Tariff Changes

BOLIVIA.—An export duty has been imposed on the export of silver, the amount of this duty being dependent on the price of silver in the London market.

POLAND.—The export of articles made in the following metals is now prohibited: Copper, nickel, cadmium, brass, German silver, Britannia metal, all alloys in shavings, splinters, and cuttings, lead in splinters. The export duty on petroleum has been increased from 50 to 150 Polish marks per kilo.

THE BRITISH ALIZARINE COMPANY LTD.

Manchester London Glasgow

Manufacturers of Alizarine Dyestuffs

ALIZARINE RED (all shades)

ALIZARINE BLUES (soluble and insoluble)

ALIZARINE BORDEAUX

ALIZARINE CYANINE

ALIZARINE GREEN (soluble and insoluble)

ALIZARINE ORANGE

ALIZARINE RED S. POWDER

ALIZARINE BLUE BLACK

ALIZARINE (MADDER) LAKES (of all qualities)

ALIZARINE MAROON

ALIZUROL GREEN (Viridine)

ANTHRACENE BROWN

ALIZANTHRENE BLUE

ALIZANTHRENE BROWN

ALIZANTHRENE YELLOW

Other fast colours of this series in course of preparation

Anthraquinone, Silver Salt and all intermediates of this series

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CHROME TANNING and other Chrome Compounds

TELEPHONES
663 Trafford Park, MANCHESTER
660 EAST LONDON
2667 DOUGLAS, GLASGOW

TELEGRAMS:
BRITALIZ MANCHESTER
BRITALIZ LONDON
BRITALIZ GLASGOW

All communications should be addressed to

The British Alizarine Co., Ltd.
Trafford Park, Manchester

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

HALL, C., AND CO., 406A, Meanwood Road, Leeds, dyers, (C.C., 28/4/23.) £28 12s. 6d. February 23.

MAYER, Mr. R., 15, Churton Road, Chester, chemical manure merchant. (C.C., 28/4/23.) £17 10s. 1d. March 12.

McCLUSKEY, Patrick, 82, Bridgwater Street, Liverpool, manufacturing chemist. (C.C., 28/4/23.) £21 8s. February 21.

STANSFIELD, Mr. J. L., Boothfold, Waterfoot, near Bury, chemical manufacturer. (C.C., 28/4/23.) £24 4s. 3d. March 12.

STORER, W. W., 33, King's Road, St. Pancras, manufacturing chemist. (C.C., 28/4/23.) £11 17s. 6d. February 14.

WEBSTER, Edgar, 37, Dawberry Road, Kings Heath, Birmingham, soap manufacturer. (C.C., 28/4/23.) £30 2s. 9d. March 5.

Receivership

ABBEY COMPANY, LTD.—E. F. Jones, of 4, Fenchurch Avenue, E.C., ceased to act as Receiver or Manager on March 31, 1923.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

CATALYTIC CHEMICAL CO., LTD., Southall. (M., 21/4/23.) Registered April 6, £900 debentures part of amounts already registered; general charge. *£9,600. January 13, 1923.

GALL (W.) AND SON, LTD., London, E.C., glue manufacturers. (M., 28/4/23.) Registered April 10, £882 8s. 7d. mortgage to J. I. Elliott, 314, St. James Road, Old Kent Road, S.E., leather manufacturer; charged on hereditament at Great Shelford and Stapleford. *Nil. December 31, 1921.

ORMSIDE SILICA WORKS, LTD., Redhill. (M., 28/4/23.) Registered April 13, £5,000 second debentures (filed under sect. 93 (3) of the Companies (Consolidation) Act 1908), present issue £1,650; general charge.

PRATT (T. H.) AND CO., LTD., London, E.C., chemists. (M., 28/4/23.) Registered April 12, £400 mortgage, to C. J. Crawshaw, Newbury, manager; charged on 154, Bartholomew Street, Newbury. *——. March 15, 1922.

PURE LIME SPAR PRODUCTS, LTD., Liverpool. (M., 28/4/23.) Registered April 16, debentures, to Bank; general charge.

TAYLORS' DRUG CO., LTD., Leeds. (M., 21/4/23.) Registered April 5, £3,800 mortgage, to F. Speight, The Ellers, Park Lane, Roundhay, contractor, and others; charged on 19, Cleveland Terrace, Linthorpe Road, Middlesbrough. *£74,796 0s. 3d. January 3, 1923.

London Gazette

Companies Winding Up Voluntarily

ASPLEY DYEING COMPANY, LTD. (W.U.V., 28/4/23.)

FERTILISERS (MANCHESTER) LTD. (C.W.U.V., 26/4/23.) C. H. Wilson, 7, Greek Street, Leeds, incorporated accountant, appointed liquidator. Meeting of creditors, 7, Greek Street, Leeds, on Monday, April 30, at 11 a.m.

Bankruptcy Information

COE, William W. (Junior), 24/26, Holborn, London, E.C., chemical manufacturer. (R.O., 28/4/23.) Receiving order, April 16. Creditor's petition. First meeting, May 1, 11 a.m., and public examination, July 11, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

YOUNG, James Albert, Mere Hall Grease Works, Bangor Street, Bolton, grease manufacturer. (R.O., 28/4/23.) Receiving order, April 18. Debtor's petition.

Partnership Dissolved

CASTON PRODUCTS CO. (Arthur Leng CASPARI and Alfred John DALTON), size manufacturers, Medwin Street, Brixton, by mutual consent from December 31, 1922.

New Companies Registered

S. H. CLAYTON, LTD., 13-16, Corridor Chambers, Market Place, Leicester. Chemists, druggists, drysalters, oil and colourmen, etc. Nominal capital, £1,000 in £1 shares.

H. HARRISON AND CO. (FINISHERS), LTD., Repton Street, Leicester. Manufacturers of and dealers in chemicals of all kinds, etc. Nominal capital, £30,000 in £1 shares.

INSECTICIDES, LTD., 102, Westcombe Hill, London, S.E. Chemists, druggists, drysalters, oil and colourmen; manufacturers of and dealers in insecticides and fertilisers, chemical, industrial and other preparations, etc. Nominal capital, £100 in 1s. shares.

JONES BI-METALS CO., LTD., Wilders Drive, Warwick Road, Birmingham. Manufacturers of sheet metals coated with nickel, silver, copper, etc. Nominal capital, £1,000 in £1 shares.

KING STREET WEST PAINT AND VARNISH CO., LTD. Manufacturers of and dealers in paints, varnishes, oils, cements, pigments, etc. Nominal capital, £1,000 in £1 shares. Solicitor: H. Mottershead, 36, Kennedy Street, Manchester.

LACTEOSOTE, LTD., 15, Great St. Andrew Street, London, W.C. Manufacturing, wholesale, retail and analytical chemists; makers of and dealers in all kinds of surgical, chemical and scientific instruments, etc. Nominal capital, £100 in £1 shares.

LAYCOCKS (ASHTON-UNDER-LYNE), LTD., William Street, Ashton-under-Lyne. Chemists, druggists, drysalters, lard compound manufacturers, etc. Nominal capital, £5,000 in £1 shares.

LUPULIN, LTD. To acquire and work a patent for an invention relating to improvements in and apparatus for the extraction of oils and resins from hops. Nominal capital, £15,000 in £1 shares. Solicitors: Stow, Preston and Lyttleton, 12, Lincoln's Inn Fields, London, W.C.2.

MERCER AND REES, LTD., Wholesale and retail chemists and druggists. Nominal capital, £1,200 in £1 shares. A subscriber: A. Baker, 38, Marmora Road, Honor Oak, London, S.E.2.

H. S. AND MILLSTREAM, LTD., 104, Bridge Street, Birkenhead. Manufacturers of artificial manures and fertilisers, manufacturing chemists and druggists, etc. Nominal capital, £50,000 in 35,000 7 per cent. cumulative preference shares of £1 each and 60,000 ordinary shares of 5s. each.

OPHTHA CO., LTD., 172, Old Christchurch Road, Bournemouth, Hants. Wholesale and retail chemists and druggists, etc. Nominal capital, £100 in £1 shares.

THAMES SOAP CO., LTD., Soap makers, perfumers, seed crushers varnish makers; manufacturers of and dealers in tallow, oil, glycerine, chemicals, etc. Nominal capital, £1,000 in £1 shares. A subscriber: J. W. Heywood, 24, Desenfans Road, Dulwich, S.E.21.

Limited Partnership

THIEL ROGERS AND CO.—Registered April 18. Druggists' sundriesmen and merchants, 41, Red Lion Street, E.C. Partnership for five years from February 1, 1923, thereafter determinable by three months' notice. General partners: K. A. Thiel, 66, Rugby Road, Brighton, and P. F. Rogers, 111, Caister Park Road, West Ham. Limited partner: C. G. Coward, 73, Brodrick Road, Wandsworth Common, S.W., contributing £500 in cash.